"APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3

SOBOLEV, N.I., inzhener.

Dispergator for making emulsified bitumen. Mekh. strei.12 No.12: 21-22 D '55. (Bitumen) (MLRA 9:2)

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"APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3

AID P - 4318

Subject : USSR/Engineering

Card 1/1 Pub. 128 - 18/26

Authors : Kazartsev, V. I., Dr. Tech. Sci., Prof. and N. I. Sobolev, Kand. Tech. Sci.

Title : Restoration of worn-out interior cylindrical surfaces by the use of changeable steel bands.

Periodical : Vest. mash., #3, p. 61-66, Mr 1956

Abstract : For repairing worn-out interior cylindrical surfaces, it is suggested that a rolled highly-resilient steel band be placed with considerable strain inside the cylinder; on unfolding the band will fit the cylinder walls tightly. The band is made mostly from a carbon alloy steel, manganese strengthened. This method is described in detail with technical data and diagrams added. 5 references, 1933-1954.

Institution : None

Submitted : No date

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"APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3

KONTSEVICH, R.S., inzh; SOBOLEV, N.I., inzh.

Cupola furnace cooled by evaporating water for smelting ore. (MIRA 14:6)
Stroi. i dor. mash. 6 no.5:28-31 My '61.
(Cupola furnaces)

APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3"

"APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3

SOBOLEV, N.I., inzh.

Equipment for obtaining mineral wool by the centrifuge-blast method. Stroi. i dor. mash. 7 no.8:32-35 Ag '62. (MIRA 15:9)
(Mineral wool)

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SOBOLEV, N.K.
CA

17

Characterization of fat from livers of commercially useful fish in the Murmansk region. N. K. Sobolev. *Rybnoe Khoz.* 27, No. 4, 54-9(1951).—Codfish fat contains on the av. 548 units vitamin A per g.; perch 1456; shark 2262; paltus-fish liver has as much as 36555 units per g. Usually the acid no. of the fat is low even in warm seasons, reaching a max. of about 2 in raw fat from the sea-perch liver. Iodine no. ranges from 154.8 in codfish to 110 in shark. Density ranges from 0.9265 for codfish to 0.9130 in shark. An n_D^{20} of 1.4775 is found for crude trawler supplied fat, 1.4779 for shark fat, 1.4691 for pressed codfish fat, and 1.4819 for mixed shark and perch fat after mild alk. hydrolysis. G. M. Kosolapoff

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"APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3

SOBOLEV, M. I.

Meditsinskii treshovyi zhir (Medicinal cod liver oil). Murmansk, Izd. Poliarnogo nauchno-issledovatel(skogo institute morskogo rybnogo khoziaistva i okeanografii; 1952, 299 p.

SO: Monthly List of Russian Accessions, Vol 6, No. 3, June 1953

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"APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3

USSR /Chemical Technology. Chemical Products and Their Application I-31

Fermentation industry

Abs Jour: Referat Zhur - Khimiya, No 9, 1957, 32913

Author : Sobolev N.K., Zhilinskiy A. Yu.

Title : Experimental Viniculture at the Martynovskiy State Farm.

Orig Pub: Vinodeliye i vinogradarstvo SSSR, 1956, No 7, 19-22

Abstract: Experience with grape processing in 1955 has shown that it is possible to produce on the left banks of the Don high grade wines ranging from light ones, blending the delicate aroma of steppe land, to the heavy, ruby-red Tsimlyanskoye wines.

Card 1/1

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SOBOLEV, N.N.

Electric railroads for the Arctic regions. Elek. i tepl. tiaga no.11: 41-42 N '57. (MLRA 10:11)

(Arctic regions--Electric railroads)

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"APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3

BAYER, V.G.; MASINO, M.A.; MASLOV, N.N.; POPOVICHENKO, G.D.; SOBOLEV, N.N.; KALOSHIN, A.I., inzh., retsenzent; SAFRONOV, S.P., inzh., retsenzent; NAUMOV, V.I., kand. tekhn. nauk, red.; YURKEVICH, M.P., inzh., red. izd-va; SHCHETININA, L.V., tekhn. red.

[Mechanic for repairing motor vehicles and tractors] Slesar' po remontu avtomobilei i traktorov. [By] B.G. Baer i dr. Moskva, Mashgiz, 1963. 318 p. (MIRA 16:10)
(Motor vehicles--Maintenance and repair)
(Tractors--Maintenance and repair)

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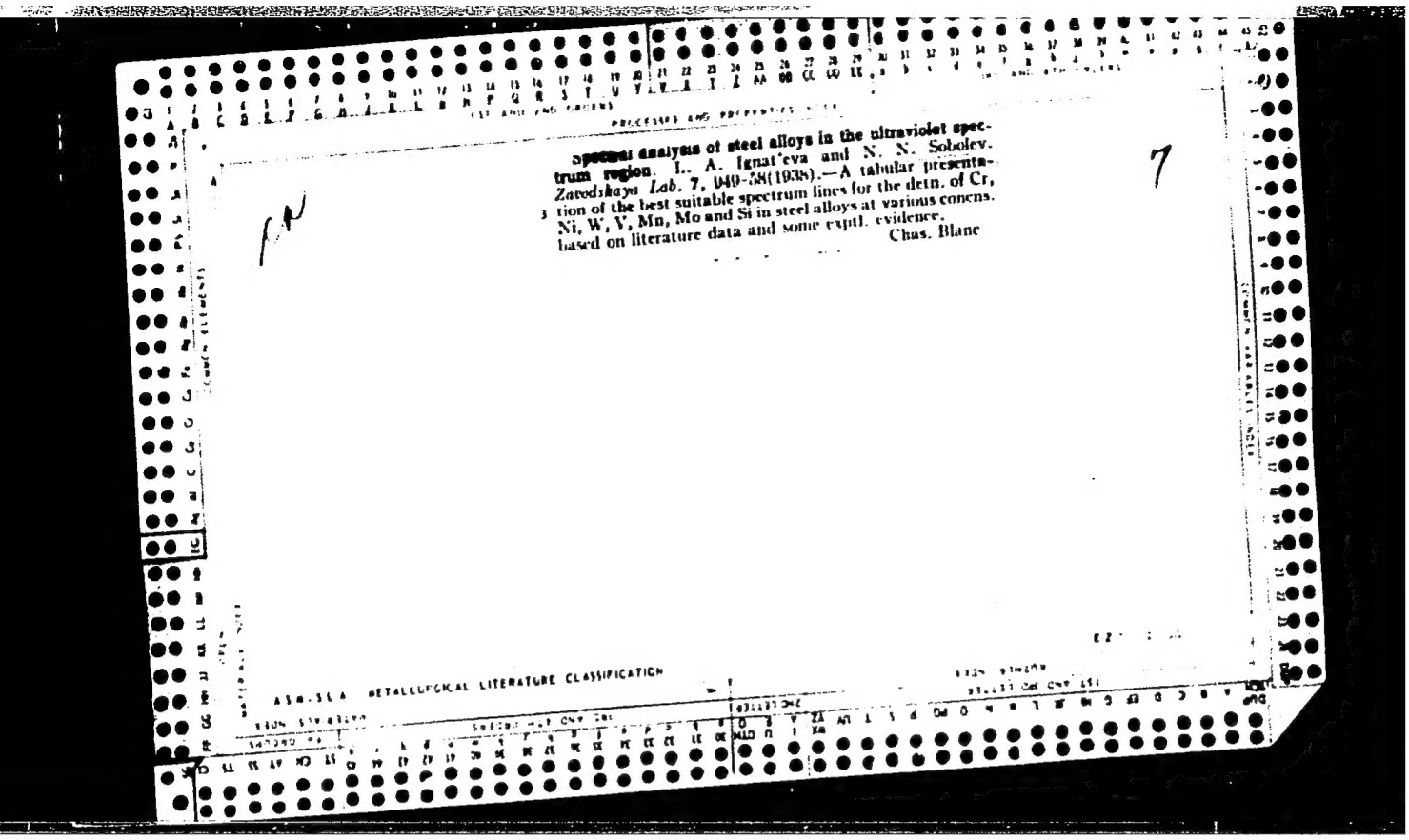

Spectral analysis of steel alloys in the ultraviolet spectrum region. L. A. Ignat'eva and N. N. Sobolev. *Zavodskaya Lab.* 7, 949–58(1938).—A tabular presentation of the best suitable spectrum lines for the detn. of Cr, Ni, W, V, Mn, Mo and Si in steel alloys at various concns. based on literature data and some exptl. evidence.
Chas. Blanc

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

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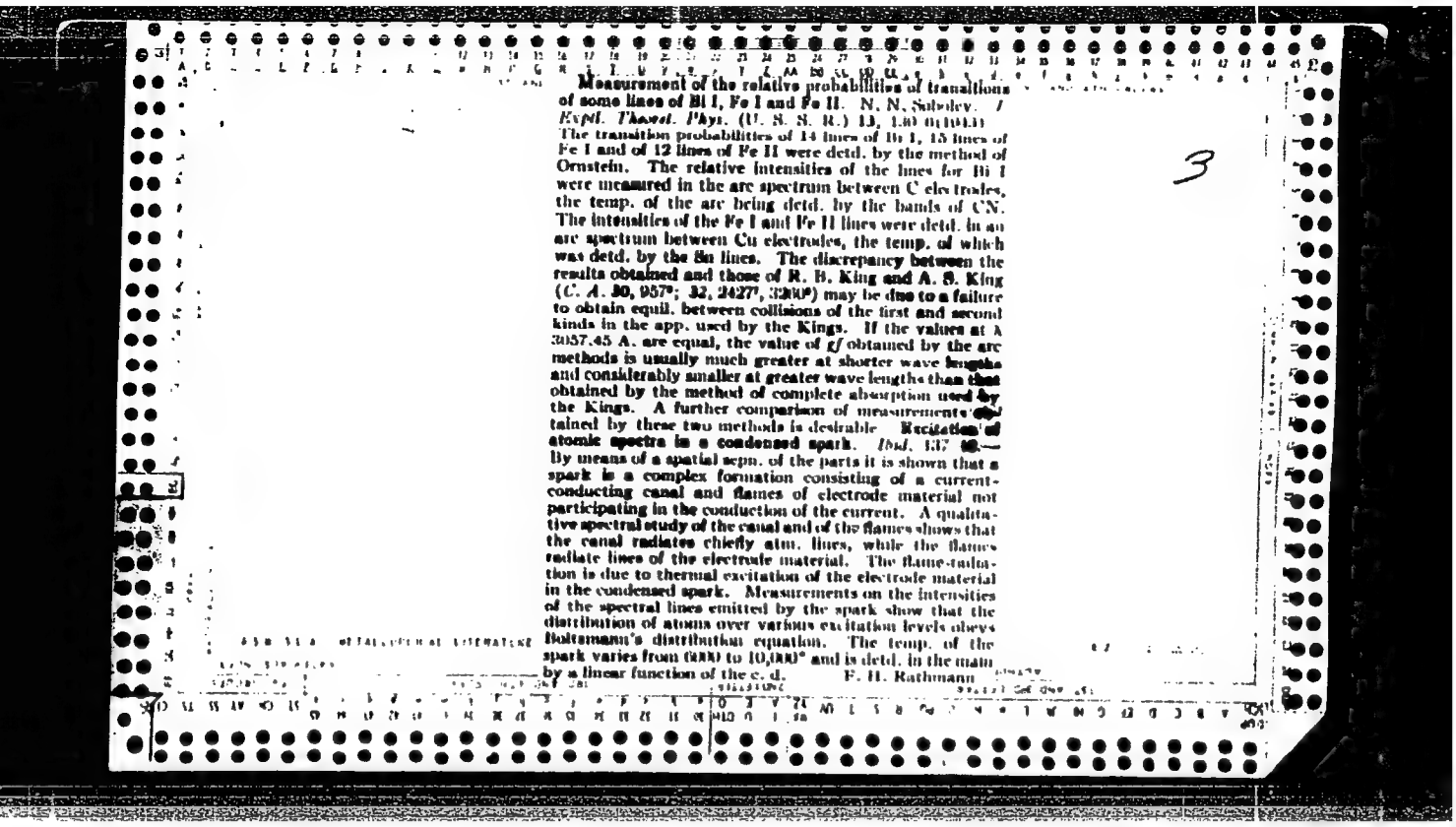

Measurement of the relative probabilities of transitions of some lines of Bi I, Fe I and Fe II. N. N. Soboley. *J. Exptl. Theoret. Phys.* (U. S. S. R.) 13, 1-10 (1943). The transition probabilities of 14 lines of Bi I, 15 lines of Fe I and of 12 lines of Fe II were detd. by the method of Ornstein. The relative intensities of the lines for Bi I were measured in the arc spectrum between C electrodes, the temp. of the arc being detd. by the bands of CN. The intensities of the Fe I and Fe II lines were detd. in an arc spectrum between Cu electrodes, the temp. of which was detd. by the Sn lines. The discrepancy between the results obtained and those of R. B. King and A. S. King (*C. A.* **30**, 957[7]; **32**, 2427[7], 3200[9]) may be due to a failure to obtain equil. between collisions of the first and second kinds in the app. used by the Kings. If the values at λ 3057.65 A. are equal, the value of gf obtained by the arc methods is usually much greater at shorter wave lengths and considerably smaller at greater wave lengths than that obtained by the method of complete absorption used by the Kings. A further comparison of measurements obtained by these two methods is desirable. **Excitation of atomic spectra in a condensed spark.** *Ibid.* 137-48.—By means of a spatial scpn. of the parts it is shown that a spark is a complex formation consisting of a current-conducting canal and flames of electrode material not participating in the conduction of the current. A qualitative spectral study of the canal and of the flames shows that the canal radiates chiefly atm. lines, while the flames radiate lines of the electrode material. The flame-radiation is due to thermal excitation of the electrode material in the condensed spark. Measurements on the intensities of the spectral lines emitted by the spark show that the distribution of atoms over various excitation levels obeys Boltzmann's distribution equation. The temp. of the spark varies from 6000 to 10,000° and is detd. in the main by a linear function of the c. d. F. H. Rathmann

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SOBOLEV, N. N.

USSR/Explosions - Measurements Nov 1946
Optical measurements

"Luminosity Temperature Measurements of Explosions by the Optical Method," M. M. Alentsev, A. F. Belyaev, N. N. Sobolev, B. N. Stepanov, 6 pp

"Zhur Eksp i Teor Fiz" Vol XVI, No 11

Investigation of the luminosity of the explosions of three liquids, methylnitrate, nitroglycol and nitroglycerine, and establishment that the luminosity radiation depends on temperature, while the spectral distribution of energy obeys Wien's formula.

PA 13757

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"APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3

ALEKTSEV, M., and SOBOLEV, N.

Among the Reports of the Academy of Sciences of the USSR. an article by SOBOLEV, N. "An optical method for the measurement of explosion temperatures." (Physical Chemistry) is listed.

SO: Doklady Akademii Nauk SSSR, #9, Vol LI, 1946, Unclassified.

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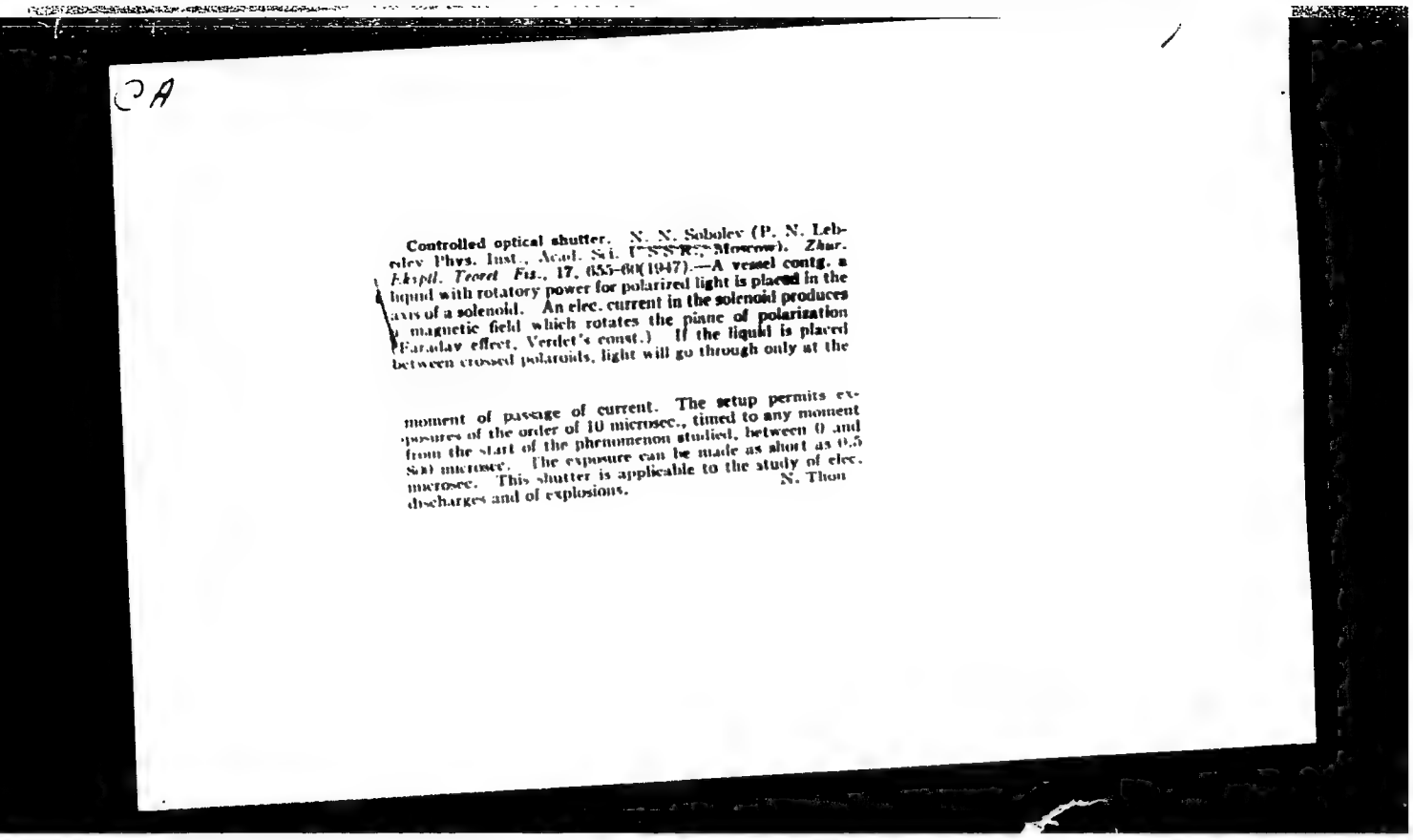

CA

Controlled optical shutter. N. N. Sobolev (P. N. Lebedev Phys. Inst., Acad. Sci. [USSR], Moscow). *Zhur. Eksptl. Teoret. Fiz.*, 17, 655-60(1947).—A vessel contg. a liquid with rotatory power for polarized light is placed in the axis of a solenoid. An elec. current in the solenoid produces a magnetic field which rotates the plane of polarization (Faraday effect, Verdet's const.) If the liquid is placed between crossed polaroids, light will go through only at the moment of passage of current. The setup permits exposures of the order of 10 microsec., timed to any moment from the start of the phenomenon studied, between 0 and 500 microsec. The exposure can be made as short as 0.5 microsec. This shutter is applicable to the study of elec. discharges and of explosions. N. Thon

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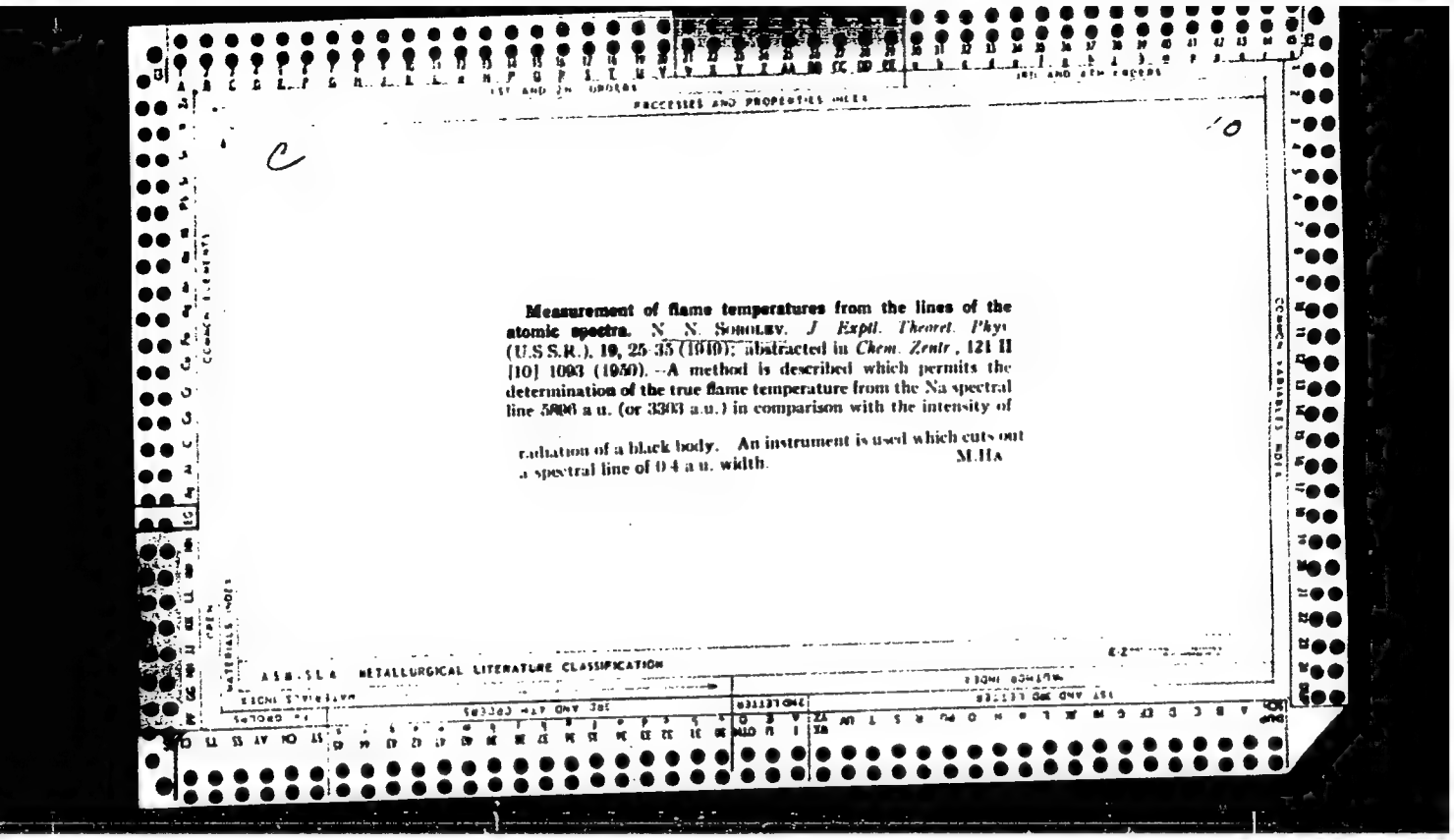

Measurement of flame temperatures from the lines of the atomic spectra. N. N. Sobolev. *J. Exptl. Theoret. Phys. (U.S.S.R.)*, **10**, 25-35 (1940); abstracted in *Chem. Zentr.*, **121** II [10] 1093 (1950). --A method is described which permits the determination of the true flame temperature from the Na spectral line 5890 a.u. (or 3303 a.u.) in comparison with the intensity of radiation of a black body. An instrument is used which cuts out a spectral line of 0.4 a.u. width. M.Ha

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3

Electric explosion of thin wires. N. N. Sobolev (P. N. Lebedev Phys. Inst., Acad. Sci. U.S.S.R., Moscow). *Zhur. Eksptl. Teoret. Fiz.* 17, 980-97(1947).—By rotating-mirror and optical-shutter observations, and by instantaneous shadow photography, elec. discharge of a condenser through a thin Cu wire produces first a disruption of the wire at several points. This stage is followed by a pause of current, and finally by a phase of gaseous discharge. A W wire behaves differently, insofar as the current is shunted by a gaseous discharge around the wire, and the latter undergoes no disruption; the energy necessary for the evapn. of the W wire is supplied prior to the appearance of the gaseous discharge. The continuous spectrum emitted by the exploding Cu wire corresponds to the spectrum of a black body at 30,000°. By approx. calcn., a 0.1 mm. Cu wire, 80 mm. long, in a circuit of 12.5 μf, 2 μH, and 10^4 v., receives the energy necessary for its fusion within 0.73 microsec., and the energy necessary for its evapn., 0.17 microsec. later. The latter energy is supplied practically instantaneously in comparison with the time required for the evapn., hence the explosion. The vapors fly out radially with a velocity of the order of 1 km./sec. The accompanying shock wave propagates at a velocity of 2 km./sec. In the pause, the current drops from about 5000 amp. to zero in a matter of 10^{-7} sec. The gaps resulting from the disruption of the wire are at first not pierced despite an induced overvoltage of the order o 50,000 v. Gaseous discharge sets in when a sufficient amt. of Cu vapor has been formed. The length of the pause is variable, ranging from 8 to 200-300 microsec. The W wire, on account of its high temps. of melting and evapn., does not evap. for the 1st hundreds of microsec. The heat necessary for its evapn. is supplied by the gaseous-discharge shunt. The discharge in air is accompanied by long (200-300 microsec.) glow, due apparently to oxidation of W.

N. Thon

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1. ALENTSEV, M. N.; SOBOLEV, N. N.

2. USSR (600)

4. Physics and Mathematics

7. Spectral Analysis of Ores and Minerals. A. K. Rusanov. (Moscow-Leningrad, State Geological Press, 1948). Reviewed by M. N. Alentsev and N. N. Sobolev. Sov. Kniga, No. 2, 1950.

9. [redacted] Report U-3081, 16 Jan. 1953. Unclassified.

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SOBOLEV, N. N.

PA 53/49T101

USSR/Physics Jul/Aug 48
Spectrum
Temperature

"Measuring Flame Temperature According to Lines of Atomic Spectra," N. N. Sobolev, 1 p

"Iz Ak Nauk SSSR, Ser Fiz" Vol XII, No 4

Shows that widely used method for measuring temperatures according to relative intensities of two or more lines with different upper energy levels is not always applicable in the case of flame. Most promising work using high concentrations of radiating atoms is that in which a substantial section of the line profile reaches saturation.

53/49T101

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CA

J

Dependence of the intensity of spectral lines on the concentration of the element in the flame. N. N. Sobolev, E. M. Mezhericher, and G. M. Rodin. *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* 14, 737(1950). The total energy of spectral lines emitted by alkali and alk. earth metals in C_2H_2 flames is at small concns. proportional to the concn. and at large concns. proportional to the $\sqrt{c}$. From contour measurements the abs. width of line Na 5890 A. was found to be 0.085 A.; that of line Ca 4227, 0.08 A. At higher concns. the contour increases owing to internal conversion. S. P.

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SOBOLEV, N. N.

USSR/Physics - Spectra Gaseous Discharge

Apr 50

"Widening of the Spectral Lines Under the Action of Ions and Electrons," S. L. Mandel'shtam, N. N. Sobolev, Phys Inst imeni Lebedev, Acad Sci USSR, 7 pp

"Zhur Eksper i Teoret Fiz" Vol XX, No 4, pp 323-9

Investigates problem on limits of applicability of collisional and statistical consideration in widening of lines by electrical fields of electrons and ions in plasma of gaseous discharge. Applies results obtained to case of widening of lines in column of an electric arc. Submitted 2 Jan 50.

PA 159T95

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"APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3

159T90

USSR/Physics - Temperature Measurements Apr 50
New Techniques

"Optical Method of Measuring Temperature in a Closed Technical Flame," N. N. Sobolev, T. I. Shchetinin, 14 pp

"Zhur Eksper i Teoret Fiz" Vol XX, No 4 p.337-70

Investigates optical properties of illumination from closed technical flame obtained by combustion of kerosene in air current. Establishes that continuous spectrum of radiation from technical flame is observed in entire visible region. Shows, for visible region of spectrum within

159T90

USSR/Physics - Temperature Measurements Apr 50
(Contd)

limits of errors of test, absorption capacity of flame does not depend upon wave length. On the basis of this, works out optical method of temperature determination with aid of measurement of energy distribution in spectrum of flame's radiation. Compares this method with method of rotation of spectral lines. Both methods give results that agree. Submitted 16 Aug 49

159T90

SOBOLEV, N. N.

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CA

Dependence of the intensity of spectral lines on the concentration of the element in the flame. N. N. Sobolev, E. M. Mezhericher, and G. M. Rodin. *Zhur. Eksptl. Teoret. Fiz.* 21, 350-60(1951).--See *C.A.* 45, 4134*d*. K. L. C.

Certain forbidden spectral lines of cadmium. John R. Holmes and Fernand Deloume (Univ. of S. California, Los Angeles). *J. Optical Soc. Am.* 42, 779(1952).--An exptl. investigation was made to establish conclusively the source and nature of the highly forbidden lines 3320 A. ($5^1 S_0 - 5^1 P_2$), 3141 A. ($5^1 S_0 - 5^3 P_2$), and 3103.1 A. ($5^1 P_1^0 - 5^3 D_1$) in Cd. All such transitions are strictly forbidden for elec. dipole radiation and by most of the selection rules for higher-pole and magnetic dipole radiation. Bowen and others, have suggested that the lines are emitted as the result of the interaction of the optical electron with the magnetic moment of the nucleus and are, therefore, produced by only the odd weighted isotopes. The intensities of the above-mentioned lines as emitted by a Cd sample that contained 2.60 times the quantity of odd isotopes contained in natural Cd were compared with the intensities of the same lines emitted by natural Cd. Within the exptl. error it was found that the forbidden lines are emitted with an intensity proportional to the odd isotope abundance and, therefore, it seems conclusively established that they arise only from the odd isotopes. The intensities of some of the forbidden lines were compared with the intensity of an allowed transition from the same multiplet in order to give a measure of the interaction of the optical electron with the nuclear magnetic moment. William F. Meggers

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Sobolev, N.N.

11300 AEC-tr-2593

OPTICAL PROPERTIES OF GASES AT HIGH TEMPERATURES AND ULTRA-HIGH PRESSURES. Yu. N. Ryabinin, N. N. Sobolev, A. M. Martsevich, and I. I. Tamm. Translated from Zhur. Eksptl. i Teoret. Fiz. 23, 564-75(1952). 13p.

A study is made of the luminosity of A heated to a temperature of some thousands of degrees by adiabatic compression. It is found that the observed line and band spectra are basically due to radiations from N_2, occurring as a contamination in the A, and from NO and OH, formed during the adiabatic compression from impurities in the A. As the density and temperature of the gas are increased, the intensity of the continuous spectrum increases more rapidly than that of the discrete spectrum. It is shown that in the ultraviolet region the distribution of energy in the continuous spectrum can be described by Wien's formula with a unique color temperature. The color temperature of the A is measured in its dependence on the compression for pressures from 2000 to 5500 kg/cm^2 and temperatures from 4000 to 9000°. (auth)

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Sobolev, N.N.

USSR.

Measurement of flame temperatures by the method of inversion of spectral lines. A. C. Sviridov and N. N. Sobolev. *Zhur. Eksptl. i Teorel. Fiz.* 24, 93–106(1953).—If the light of a W band lamp is projected through a flame to which a Na salt has been added, the Na lines appear as emission lines at lower and as absorption lines at higher temp. of the flame with respect to the band lamp. The disappearance of the lines at equal temp. is called inversion. The theory of this method for a finite width of the spectral line is discussed. It is shown that the temp. of the flame can be detd. from measurements of the intensities of the spectral line with and without illumination and the intensity of the lamp illumination background next to the line. A photographic method based on the theory has been worked out, which does not require equalization of temp. The spectrographic installation has a step filter between the lamp and the flame. For min. error the lamp temp. must be higher than the flame temp. In case of lower temp. of the lamp the temp. difference should not exceed 200–300° for an error of 2%. S. Pakswer

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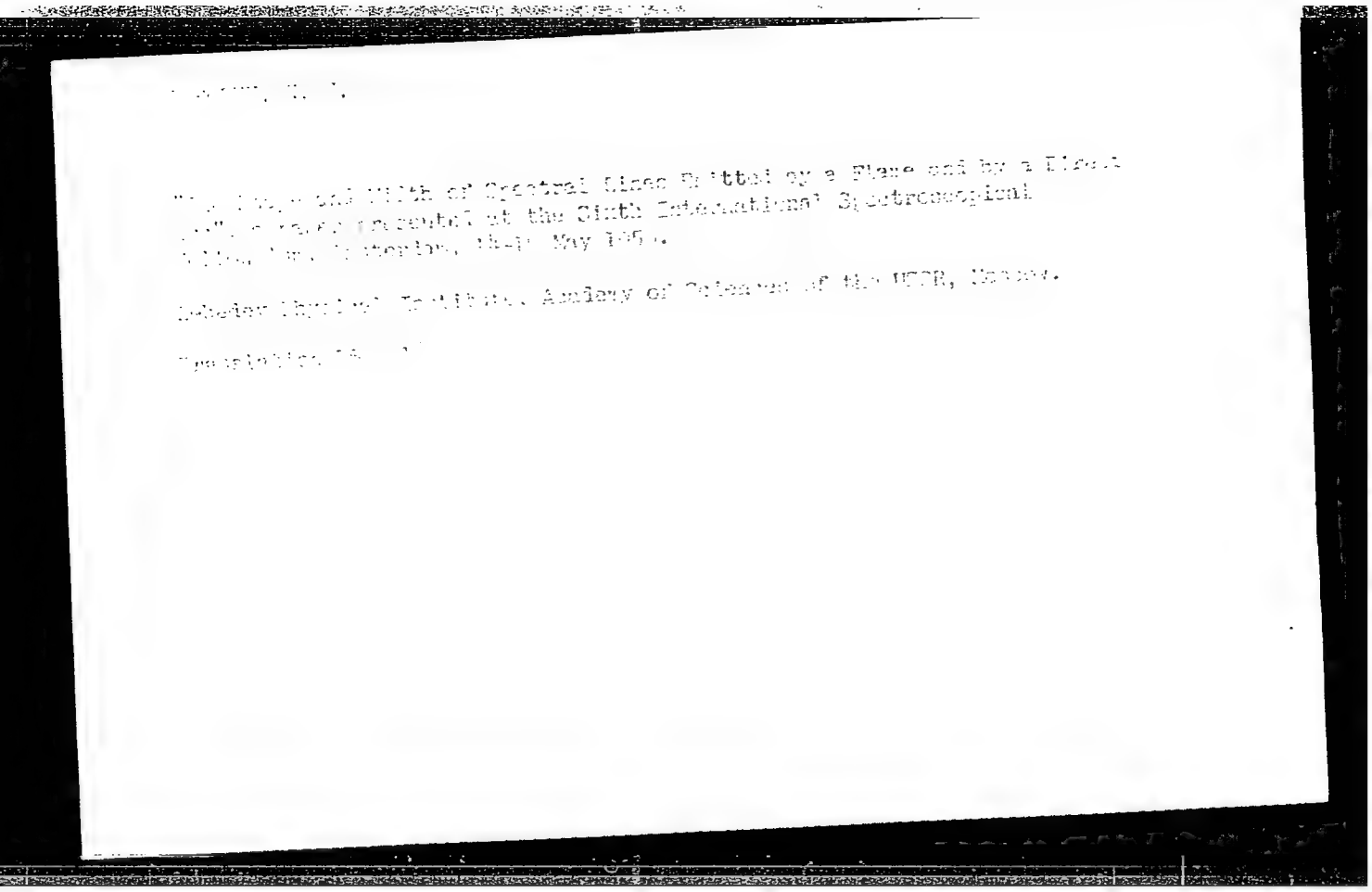

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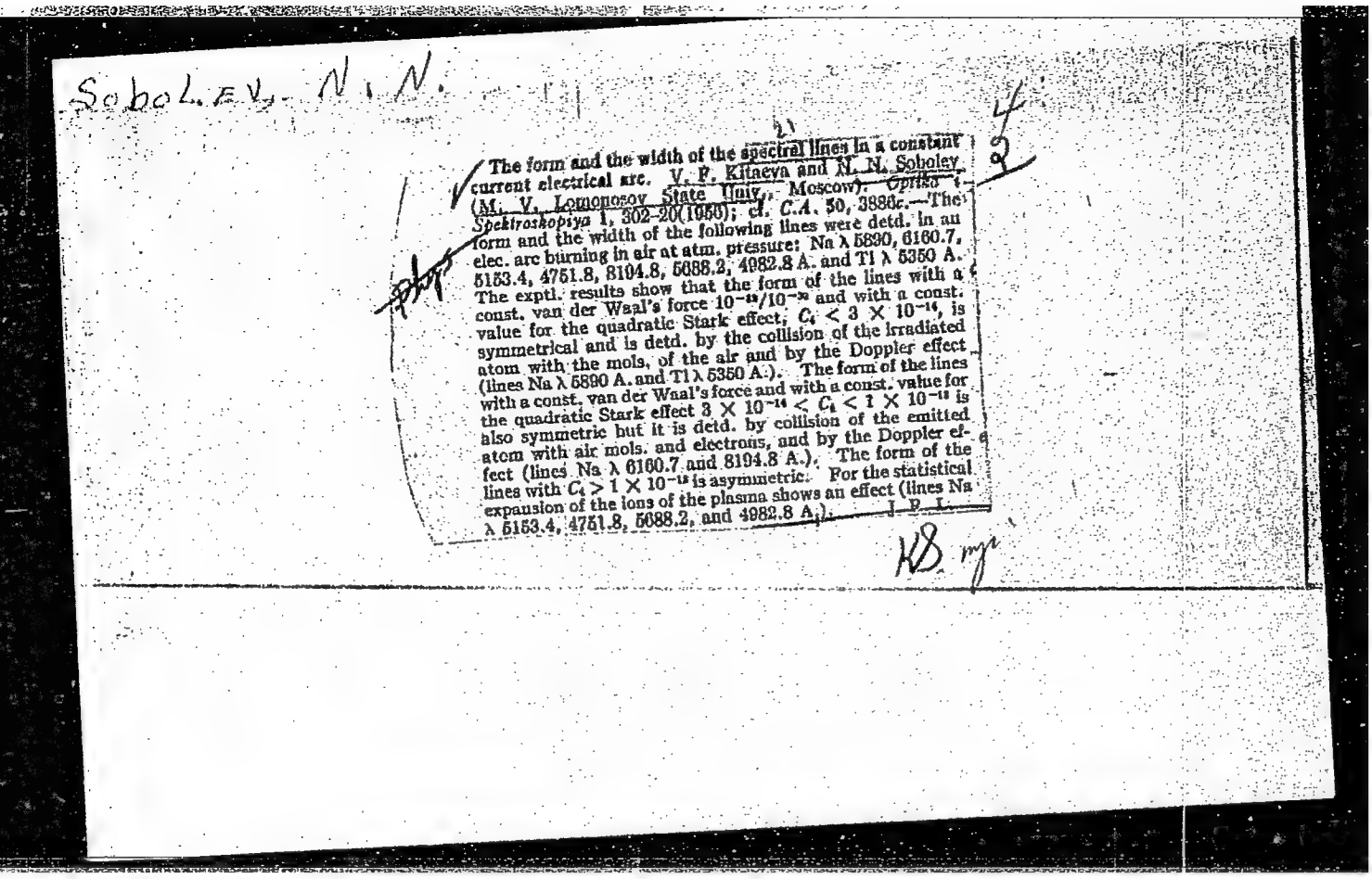

Sobolev, N. N.

The form and the width of the spectral lines in a constant current electrical arc. V. P. Kitaeva and N. N. Sobolev. (M. V. Lomonosov State Univ., Moscow). *Optika i Spektroskopiya* 1, 302-20(1956); cf. *C.A.* 50, 3886c.—The form and the width of the following lines were detd. in an elec. arc burning in air at atm. pressure: Na λ 5890, 6160.7, 5153.4, 4751.8, 8194.8, 5688.2, 4982.8 A. and Tl λ 5350 A. The exptl. results show that the form of the lines with a const. van der Waal's force $10^{-32}/10^{-30}$ and with a const. value for the quadratic Stark effect, $C_4 < 3 \times 10^{-14}$, is symmetrical and is detd. by the collision of the irradiated atom with the mols. of the air and by the Doppler effect (lines Na λ 5890 A. and Tl λ 5350 A.). The form of the lines with a const. van der Waal's force and with a const. value for the quadratic Stark effect $3 \times 10^{-14} < C_4 < 1 \times 10^{-13}$ is also symmetric but it is detd. by collision of the emitted atom with air mols. and electrons, and by the Doppler effect (lines Na λ 6160.7 and 8194.8 A.). The form of the lines with $C_4 > 1 \times 10^{-13}$ is asymmetric. For the statistical expansion of the ions of the plasma shows an effect (lines Na λ 5153.4, 4751.8, 5688.2, and 4982.8 A.). I. P. L.

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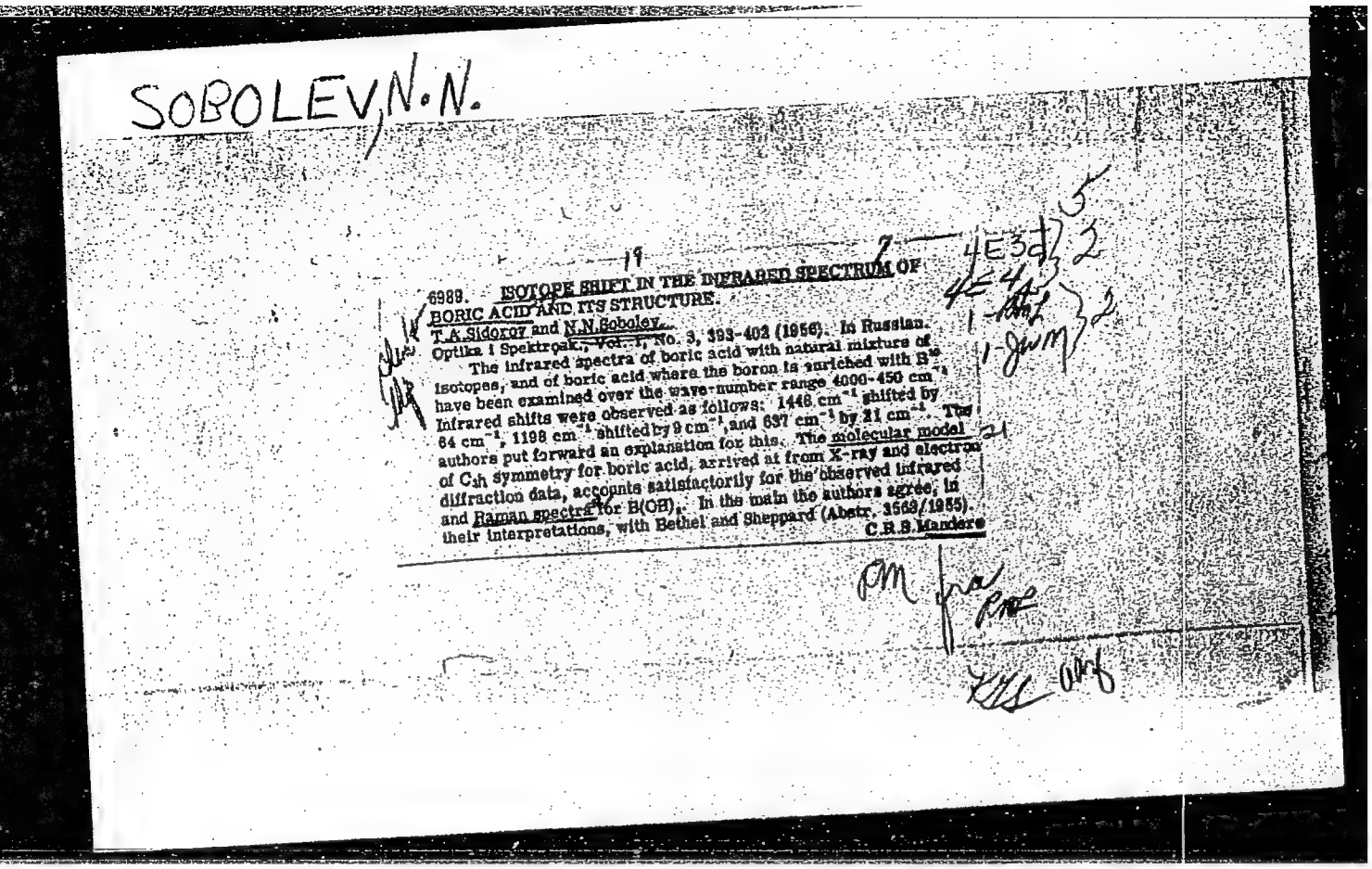

SOBOLEV, N.N.

6989. ISOTOPE SHIFT IN THE INFRARED SPECTRUM OF BORIC ACID AND ITS STRUCTURE.
T.A. Sidorov and N.N. Sobolev.
Optika i Spektroskop., Vol. 1, No. 3, 393-402 (1956). In Russian.

The infrared spectra of boric acid with natural mixture of isotopes, and of boric acid where the boron is enriched with B^{10}, have been examined over the wave-number range 4000-450 cm^{-1}. Infrared shifts were observed as follows: 1448 cm^{-1} shifted by 64 cm^{-1}, 1198 cm^{-1} shifted by 9 cm^{-1}, and 887 cm^{-1} by 21 cm^{-1}. The authors put forward an explanation for this. The molecular model of C_{3h} symmetry for boric acid, arrived at from X-ray and electron diffraction data, accounts satisfactorily for the observed infrared and Raman spectra for $B(OH)_3$. In the main the authors agree, in their interpretations, with Bethel and Sheppard (Abstr. 3569/1955).
C.R.S. Mandera

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LOTKOVA, E.N.; OBUKHOV-DENISOV, V.V.; SOBOLEV, N.N.; CHEREMISINOV, V.P.

Infrared and Raman spectra of boric anhydride. Part 1. Opt. i spektr. 1 no.6:772-782 D '56. (MLRA 9:12)

1. Fizicheskiy institut imeni P.N. Lebedeva Akademii nauk SSSR.
(Boron oxides--Spectra)

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Sobolev N.N.

Optical methods for measuring temperatures of flames. N. N. Sobolev. *Trudy Fiz. Inst., Akad. Nauk S.S.S.R., Fiz. Inst. im. P. N. Lebedeva* 7, 160–229(1956).—An analysis of the optical methods for measuring flame temps. showed that the form and the width of spectral lines of the acetylene-air flame is detd. by the Doppler effect and by the collisions between the ebullient atoms and the mols. of gases comprising the flame. At low optical width of the flame, the half-width of the lines varied from 0.05 A. to 0.15 A. The value of the parameter $a = \Delta\omega_L/\Delta\omega_D$ (where $\Delta\omega_L$ and $\Delta\omega_D$ are Lorentz and Doppler half-width, resp.), which dets. the shape of the line in the presence of both the collisions and the Doppler effect, was within the limits 2–6. This means that the increase in the width of spectral lines due to collisions is of the same order as that due to the Doppler effect. The optically effective cross section of the collisions of Na (9.2 A.), Li (7.3 A.), Tl (10.7 A.), and Ca (10.5 A.) atoms with the mols. of gases in narrow flames were 2–3 times greater than their kinetic cross sections. In optically wide flames the half-width of spectral lines increased with an increase in the concn. of cations, and the lines assumed tablelike shape followed by the satn. of the line centers. For example, the half-width of the D line of Na at low optical widths ($N < 10^{10}$ atoms/cc.) was 0.09 A.; at higher optical widths ($N \sim 10^{13}$ atoms/cc.) the half-width was 0.74 A. and was accompanied by a plateau 0.12 A. wide. The linear relation between the integral of the intensity of lines and the concn. of atoms (N) at a flame temp. of 2600°K. was observed only

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when the interval of change in the concn. was ≤30. The reabsorption-characterized relation of the type $E_\lambda \sim N^{0.4}$ (E_λ, intensity of spectral lines) for the most intense resonating lines was found to be true only with a 1000-fold change in the concn. of the atoms. The min. concn. of atoms, recorded photoelectrically was of the order of 10^{10} atoms/cc., i.e., one atom per 10^8 mols. of the flame gases. The introduction into the flame of satd. solns. of alkali metal and alkaline earth salts raised the concn. of atoms to 10^{12}–10^{13} atoms/cc. From a series of derived equations relating the half-width of lines in emission spectrum at atm. pressure, it was deduced and experimentally confirmed that with a decrease in the temp. the half-width ($\Delta\lambda$) increased: lowering the temps. from 3500° to 1500°K increased $\Delta\lambda$ from 0.08 A. to 0.10 A.; from 1500°K to 500°K it increased from 0.10 A. to 0.14 A. The analysis of the Ornshtein method for measuring the temp. of flames showed that it is ineffective at temps. <2000°K, and the method becomes expedient only with flames >3000°K, because it is based on the assumption that the reabsorption process is absent. Another disadvantage of the Ornshtein method is the requirement of information about the optically effective cross sections of collisions, which are not at. consts. but are related to the compn. of the gases in flames. The method is based on the intensity of the center of the satd. line which depends only on the wave length and temp. does not require the knowledge of at. consts. However, the high concns. of the mixts. required by the method can lead to changes in the phys. properties of the flames. The analysis of the method based on the conversion of spectral lines (i.e., detn. of absorbing power of the flame with a line of a given wave length) and the intensity of the flame showed that this method can be adapted to nonstationary technical flames. The app. is described.

A. P. Kotloby

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SOBOLEV, N.N

PRIKHOT'KO, A.F

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L'vov. Universytet

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Sidorov, T. A.

51-6-5/26

AUTHORS: Sidorov, T. A. and Sobolev, N. N.

TITLE: Infrared Spectrum and Molecular Structure of Phosphorus Trioxide. (Infrakrasnyy spektr i struktura molekuly fosforistogo angidrida.)

PERIODICAL: Optika i Spektroskopiya, 1957, Vol.II, Nr.6, pp. 710-716. (USSR)

ABSTRACT: Infrared spectrum of phosphorus trioxide (P_2O_3) was studied in the region from 2.5 to 24μ. The trioxide was prepared using the method of Thorpe and Tutton (Ref.1). During preparation the trioxide was placed in a current of carbon dioxide to prevent attack by oxygen and moisture of the atmosphere. The measurements were made on liquid trioxide. The liquid was prepared by melting a piece of trioxide between two plates of KI. The spectrum was measured using a double-beam infrared spectrometer described in Ref.5. A 'Silit' resistor heated to about 1000°C was used as the source of light. A blackened bismuth bolometer was used as a detector. The measured infrared spectrum

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Infrared Spectrum and Molecular Structure of Phosphorus Trioxide.

is shown in Fig.1. The frequencies and the intensities of the absorption bands are given in Table 1. It was found that phosphorus trioxide possesses 3 strong absorption bands with frequencies of 636, 911 and 1270 cm^{-1}. In order to discuss the molecular structure of phosphorus trioxide in liquid state the infrared spectrum was compared with the Raman scattering spectrum (Ref.1). The latter spectrum has 7 or 8 fundamental frequencies which are shown in Table 1. From the available evidence the authors conclude that the vibrational spectrum of phosphorus trioxide can be explained only by using the molecular model of P_4O_6 which belongs to a symmetry point-group T_d. Molecular models of the trioxide which belong to other point-groups, or those which belong to group T_d but have more than 10 atoms, yield results which differ greatly from the observed values. Fig.2 shows the proposed structure of phosphorus trioxide. Table 3 gives the interpretation of the infrared and Raman

 spectra of phosphorus trioxide. These spectra can be

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satisfactorily interpreted only by using a molecular model of P_4O_6 belonging to the point-group T_d. These conclusions are in full agreement with electron diffraction studies of phosphorus trioxide vapours (Ref.2). There are 2 figures, 3 tables and 6 references, 2 of which are Slavic.

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51-6-6/26

AUTHORS: Sidorov, T. A. and Sobolev, N. N.

TITLE: Infrared Spectrum and Molecular Structure of Phosphorus Pentoxide. (Infrakrasnyy spektri struktura molekuly fosfornogo angidrida.)

PERIODICAL: Optika i Spektroskopiya, 1957, Vol.II, Nr.6, pp. 717-723. (USSR)

ABSTRACT: Phosphorus pentoxide (P_2O_5) exists in two crystalline modifications (Ref.1). The volatile modification is obtained from pentoxide vapours at room temperature. The second modification, which is difficult to vaporise, is formed from the volatile modification by prolonged heating at about 500°C. In gaseous state phosphorus pentoxide has the composition given by P_4O_{10} and belongs to the T_d point-group. X-ray diffraction studies show that the volatile modification of phosphorus pentoxide in solid state also consists of molecules of P_4O_{10} with T_d symmetry. To confirm spectroscopically the X-ray diffraction data the infrared and Raman spectra of phosphorus pentoxide should be known. Ref.4 gives the

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51-6-6/26

Infrared Spectrum and Molecular Structure of Phosphorus Pentoxide.

Raman scattering spectrum for the volatile modification for phosphorus pentoxide. The present paper reports measurements of the infrared spectrum of phosphorus pentoxide in its volatile modification. These measurements were made in the region from 2.5 to 24 μ on chemically pure pentoxide obtained by sublimation in dry oxygen. Since phosphorus pentoxide absorbs strongly the atmospheric moisture the samples were prepared in vacuo by deposition of thin layers. The measurements were carried out with the samples still in vacuo. The infrared spectrum is shown in Fig.2, the absorption frequencies and intensities are given in Table 1. Fig.2 and Table 1 show that phosphorus pentoxide exhibits four strong absorption bands with the frequencies of 573, 764, 1015 and 1390 cm^{-1}. Table 1 contains also the frequencies and intensities of the Raman scattering spectrum taken from Ref.4. The Raman spectrum possesses 12 strong lines, 11 of which can be regarded as fundamental. From the available evidence the authors conclude that the best agreement

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Infrared Spectrum and Molecular Structure of Phosphorus Pentoxide.

with experimental results is obtained by a molecular model of P_4O_{10} belonging to the T_d group (Fig.3). Table 3 gives the interpretation of the infrared and Raman scattering spectra for phosphorus pentoxide. This interpretation is satisfactory only for the molecule P_4O_{10} of the T_d point-group. These conclusions are in good agreement with the X-ray diffraction data of Ref.1. There are 3 figures, 3 tables and 9 references, 3 of which are Slavic.

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LOTKOVA, E.N.; OBUKHOV-DENISOV, V.V.; SOBOLEV, N.N.; CHERKASINOV, V.P.

Raman spectra of vitreous boron oxide. Fiz. sbor. no.3:445-448 '57. (MIRA 11:8)

1. Fizicheskiy institut im. P.N. Lebedeva AN SSSR.
(Boron oxide--Spectra) (Raman effect)

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AUTHORS: Sobolev, N.N. and Fayzullov, F.S. 51-2-8/15

TITLE: A photoelectric pyrometer for measurement of the colour temperature of flames. (Fotoelektricheskiy pirometr dlya izmereniya tsvetovoy temperatury plamen).

PERIODICAL: "Optika i Spektroskopiya" (Optics and Spectroscopy) 1957, Vol.3, No.2, pp.162-168 (U.S.S.R.)

ABSTRACT: The colour temperature measurements are employed for distant objects and those whose absorption is near to a grey body but is not known exactly. The aim was to construct an instrument for measurement of the colour temperature of non-stationary and short-duration flames. The work was carried out in 1949-1950. A single-channel photoelectric pyrometer is described first. It is shown schematically in Fig.1. An objective 2 (numbers refer to Fig.1 designations) focuses an image of the flame 1 onto a slit 3. Behind the slit there is a disk 4, rotated by a motor 8 at 3000 rev/min, which carries three filters: red 7, blue 9 and green (not shown in Fig.1). The filtered light falls on a photoelement 6 which is followed by an amplifier 10 and a cathode-ray oscillograph 11. For non-stationary flames the c.r.o. display (50 c/s) was photographed with a ciné camera. A typical record is shown in Fig.2 with red, blue and green pulses from left to right. This pyrometer was calibrated with a lamp LT-1. The brightness temperatures

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A photoelectric pyrometer for measurement of the colour temperature of flames. (Cont.)

of this lamp were measured with a disappearing-filament pyrometer and these temperatures were converted, using tables, into colour temperatures given as a function of the lamp current. The lamp was placed at 1 in Fig.1 and by variation of its current for each (known) colour temperature a set of values was obtained for the ratios of the c.r.o. pulse intensities for blue and red, and for green and red. These are given in Fig.3. The described single-channel photoelectric pyrometer is suitable only for flames which are stationary during one revolution of the filter disk (in this case 1/50 sec). It is, however, suitable for measurement of average colour temperatures. For measurement of very rapidly changing colour temperatures a two-channel photoelectric pyrometer was constructed. It is shown schematically in Fig.4, where 1 = an additional source of light for measurement of flame absorption, 2, 4 and 7 are lenses, 3 = the flame, 5 = a slit, 6 = a modulating disk with 24 apertures, rotated by a motor 11, 8 = a semitransparent aluminized glass plate (beam-splitter), 9 (6400 Å pass-band) and 12 (4500 Å) are filters, 10 and 13 are photoelements, 14, 15, 16 and 17 are amplifiers, 18 is a vibration (string) oscillograph,

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A photoelectric pyrometer for measurement of the colour temperature of flames. (Cont.)

19 is a "logometer", an instrument for measuring a ratio of two electrical quantities (currents). The electronic circuit is given in Fig.5. The two-channel pyrometer was calibrated using the LT-1 lamp and the vibration oscillograph. This calibration was checked by six measurements carried out during one day using green and infrared filters. The results of this check (see Fig.6) show that errors are of the order of 20°K or 1%. The pyrometer was also calibrated between 2200 and 3100°K using an LT-2 lamp and two milliammeters instead of the vibration oscillograph. The results are plotted in Fig.7 as the logarithm of the current ratio ($\log n_K/n_C$) against the reciprocal of the colour temperature ($10^6/T$). To avoid the necessity of calculation of the current (milliammeters) or the intensity (vibration oscillograph) ratios a "logometer", which gives mean current ratios for periods of 1-2 sec, could be used. The logometer must be graduated and the temperature error does not exceed 10°K. The calibration of the two-channel pyrometer described here is valid for one working day. The two channel pyrometer can also be used for measurement of the brightness temperature

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51-2-8/15

A photoelectric pyrometer for measurement of the colour temperature of flames. (CONT.)

and the flame absorption (using an additional source of light, 1 in Fig.4). There are 9 figures; 6 references (4 of which are Slavic).

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SOV/51-6-3/25

AUTHORS: Sidorov, T. A., and Sobolev, N. N.

TITLE: Infrared and Raman Spectra of Boron Oxide. (Infrakrasnyy i kombinatsionnyy spektry bornogo angidrida.) II. Infrared Spectrum and Structure of the Boron Oxide Molecule. (II. Infrakrasnyy spektr i struktura molekuly bornogo angidrida.)

PERIODICAL: Optika i Spektroskopiya, 1957, Vol. III, Nr. 6, pp. 560-567. (USSR)

ABSTRACT: The preceding paper (Ref.1) reported the results on the Raman spectrum of glassy boron oxide. The present and subsequent papers report measurements of the infrared spectrum and interpret the vibrational spectrum of the same substance. The infrared spectrum was obtained in the region 2.5 - 24 μ for the usual glassy boron oxide and for the same oxide enriched with B^{10}, using a double-beam spectrometer described in Ref.3. A monochromator of a ИКС-11 spectrometer with NaCl and KBr prisms was used. A "silit" rod heated to 1000°C was used as the infrared source. The absorption

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Infrared and Raman Spectra of Boron Oxide. II.

Spectra were recorded using a blackened bismuth bolometer. Chemically pure boron oxide was used. Oxide enriched with B^{10} was produced by prolonged heating of enriched boric acid in vacuum. By drawing thin layers from the melt a glassy substance was obtained. These layers were about 1 μ thick and 2 x 3 cm^2 in area. The form of the spectrum depended strongly on the time the layer (film) was kept in air. Fig.3 shows six different absorption spectra obtained after 0 - 48 hours in air. To avoid the effect of atmospheric moisture and to make the samples as small as possible a different method was used. After heating to 1000°C to remove water, the oxide temperature was increased to 2000°C and a film of oxide was evaporated on a KBr plate. To study weak absorption bands 0.02 mm films were prepared. The usual boron oxide studied had 18.83% B^{10} and 81.17% B^{11}. The enriched oxide had 71% B^{10}. The infrared spectra of these oxides are given in Figs. 1 and 2 respectively. Boron oxide (Fig.1 and Table 1) has three strong absorption bands at 1330, 1260 and 718 cm^{-1}. These bands exhibit

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Infrared and Raman Spectra of Boron Oxide. II.

strong absorption even in 1 μ films. There are also some frequencies at which absorption is noticeable only in layers 20 μ thick. The 1260 and 718 cm^{-1} bands exhibit isotopic displacement by 21 and 6 cm^{-1} respectively (Fig.2 and Table 1). The infrared spectra of boron oxide films evaporated in vacuum, and all layers prepared by drawing from melt (not exposed to air) were found to be almost identical. According to Zachariasen (Ref.9), boron oxide has coordinational structure in which there are no separate molecules, but according to Fajans and Barber (Ref.10), this oxide consists of molecules which are bound together by considerable intermolecular forces. The present authors favour the molecular structure hypothesis. Table 2 collects the Raman (cols. 1 and 2) and infrared (cols. 3 and 4) spectra of boron oxide. Of these, 1330, 1260 and 718 cm^{-1} frequencies of the infrared spectrum are regarded as fundamental. In the Raman spectrum the eight strong or medium frequencies are regarded as fundamental (470, 508, 670, 725, 808,

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51-4-1-2/26

AUTHORS: Sidorov, T. A. and Sobolev, N. N.

TITLE: The Infrared and Combination Spectra of Boron Oxide III. Interpretation of the Vibrational Spectrum of Boron Oxide and Calculation of the Isotopic Effect. (Infrakrasnyy i kombinatsionnyy spektry bornogo angidrida. III. Interpretatsiya kolebatel'nogo spektra bornogo angidrida i raschet izotopicheskogo effekta.)

PERIODICAL: Optika i Spektroskopiya, 1958, Vol. IV, Nr. 1, pp. 9-16. (USSR)

ABSTRACT: In the preceding two parts (Ref.1) it was shown that a molecule of boron oxide has the formula B_4O_6 and belongs to the symmetry point-group T_d. Structure of such a molecule is shown in Fig.1. Atoms of boron are at the vertices of a tetrahedron, and atoms of oxygen are on straight lines joining the centre of the tetrahedron with centres of the sides of the tetrahedron. Due to the high symmetry of the molecule, 24 of its normal vibrations degenerate to 10. The

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The Infrared and Combination Spectra of Boron Oxide. III.

molecule has two fully-symmetric and totally polarized vibrations of the type A_1 which are active only in the Raman spectrum; two doubly degenerate vibrations of the type E which are also active only in the Raman spectrum; two triply degenerate vibrations of the type F_1 which are forbidden both in the Raman and in the infrared spectrum, and four triply degenerate vibrations of the type F_2 which are active both in the Raman and the infrared spectra. Force constants are calculated for a valence model of B_4O_6 on the assumption that, firstly, B_4O_6 molecule belongs to the T_d point-group of symmetry and, secondly, that the three experimentally observed

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The Infrared and Combination Spectra of Boron Oxide. III. 51-4-1-2/26

frequencies at 1035, 808 and 470 cm^{-1} belong to the A_1, A_1 and E types of symmetry respectively. The force constants were calculated to be $f = 5.852 \times 10^5$, $d = 0.644 \times 10^5$ and $\delta = 0.590 \times 10^5$ dynes/cm. Details of calculations of the force constants and frequencies for boron oxide were reported in a dissertation by T. A. Sidorov. Using these force constants the frequencies of the remaining seven fundamental vibrations of the molecules were found to be: type E: 1372 cm^{-1}; type F_1: 1505, 383 cm^{-1}; type F_2: 1428, 1059, 671 and 671 cm^{-1}. Comparison of the calculated and observed frequencies is given in Table 1; the second row in that table gives the observed values. One frequency, at 1260 cm^{-1} differs by 16% from the calculated value of

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The Infrared and Combination Spectra of Boron Oxide. III. 51-4-1-2/26

1059 cm^{-1}, but for other frequencies the difference between the calculated and experimental values does not exceed 10%. This is considered to be satisfactory in view of the approximations made. Seven strongest Raman and three strongest infrared bands are interpreted as fundamental (Table 2). Weak bands of the infrared and Raman spectra may be represented as first harmonics, sums, and differences of the fundamental vibration. The observed departure from selection rules and the high degree of depolarization of the 808 cm^{-1} band is due to considerable intramolecular forces in boron oxide. To study vibrational spectra of isotopic molecules, the infrared spectrum of boron oxide enriched with B^{10} isotope was measured. The enriched oxide had 71% of B^{10} and 29% of B^{11}, compared

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The Infrared and Combination Spectra of Boron Oxide. III.

with natural composition of 18.83% of B^{10} and 81.17% of B^{11}. On enrichment of B_4O_6 with B^{11} an isotopic displacement was observed in two bands of the infrared spectrum: 21 cm^{-1} at 1260 cm^{-1} band and 6 cm^{-1} at 718 cm^{-1} band. The 1330 cm^{-1} band in the wing of the 1260 cm^{-1} line, and its isotopic displacement could not be observed. Both in the usual boron oxide and in the enriched oxide there are five different isotopic molecules: $B_4^{11}O_6$, $B_3^{11}B^{10}O_6$, $B_2^{11}B_2^{10}O_6$, $B^{11}B_3^{10}O_6$, $B_4^{10}O_6$. The percentage content of these isotopic molecules in natural and enriched oxide is given in Table 3. The calculated isotopic displacements between frequencies of molecules $B_4^{11}O_6$ and $B_4^{10}O_6$ are given in Table 4. The absorption bands of the oxide may be represented by means of

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51- 4-1-2/26

The Infrared and Combination Spectra of Boron Oxide. III.

All the strongest Raman bands of glassy B_4O_6 were observed in liquid B_4O_6 as well (Ref.1). The very strong infrared band at 1260 cm^{-1} was found in the infrared spectrum of B_4O_6 up to 1000°C (Ref.12). This shows that the molecular structure of boron oxide is similar in the glassy and liquid states. The authors thank F. I. Strizhevskaya for help in calculations. There are 2 figures, 5 tables and 12 references, of which 5 are Russian, 5 English and American, 1 German and 1 French.

ASSOCIATION: Physics Institute imeni P. N. Lebedev, Academy of Sciences of the USSR. (Fizicheskiy institut im. P. N. Lebedeva AN SSSR.)

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Card 7/7 1. Boron oxides-Molecular structure 2. Boron oxides-Vibration-Spectrum

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KITAYEVA, V.F.; SOBOLEV, N.N.

Broadening of spectrum lines in a d.c. arc. Fiz.sbor. no.4: 312-315 '58. (MIRA 12:5)

1. Fizicheskiy institut imeni P.N.Lebedeva AN SSSR.
(Electric arc) (Spectrum analysis)

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On Measurement of Flame Temperatures by the Method of Relative Intensities of Spectral Lines

these lines were determined by finding their relative intensities in flames and measuring the flame temperature by the method using reversal of spectral lines. Fig 1 gives the apparatus used to produce controlled hydrogen-oxygen flames; 1 and 7 are reducing valves, 2 and 6 are mercury monometers, 3 is an atomizer, 4 is a device for trapping of larger drops of $LiNO_3$ and NaBr solutions, which are used as sources of Li and Na, 5 is a mixing chamber, 8 is a calibrated capillary and 9 is a burner. The apparatus used for producing acetylene-air flames was described in Ref 9. The flame temperature was measured using reversal of spectral lines. In measurement of temperature of acetylene-air flames the authors used a lamp with a tungsten ribbon as a light standard. Temperature of hydrogen-oxygen flames was measured using a carbon arc as an auxiliary source. The following lines were used for these measurements; Li at 6707.8 Å and Na at 5890-96 Å. The acetylene-air flame temperature was found to be 2420°K and that of the hydrogen-oxygen flame was found to be 3080°K. The flame spectra were photographed using an ISP-51 spectrograph. As a check of the results obtained, the line intensities were measured also using a photoelectric setup shown in Fig 2, where 1 is a light

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On Measurement of Flame Temperatures by the Method of Relative Intensities of Spectral Lines

source , 2 a modulator disk, 3 a source of reference voltage, 4 is a spectrograph, 5 a photoelectric receiver consisting of two exit slits and 2 photomultipliers, 6 are amplifying cascades, 7 a synchronous detector and 8 is an end cascade. The transition probabilities of the Li and the Na lines, determined from their relative intensities and flame temperatures, are given in Tables 1 (Na lines) and 2 (Li lines). The 4982 Å Na line and the 6104 Å Li line were used as standards and their transition probabilities were taken to be equal to 1.00. Tables 3 and 4 give the mean experimental values (obtained by the present authors) of the transition probabilities of the Na and Li lines respectively. These values are given in the fourth columns of Tables 3 and 4 and are compared with the experimental values of Key (Ref 5), which are listed in the fifth columns, and with the theoretical values of Refs 6, 7 and 8 which are given in the sixth and later columns. There seems to be no agreement between Key's results and those obtained by the present authors. This may be due to the fact that Key used an arc as his light source. The theoretical values of

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SOV/51-5-5-2/23

On Measurements of Flame Temperatures by the Method of Relative Intensities of Spectral Lines

spectral lines described in the present paper. There are 3 figures, 4 tables and 14 references, 7 of which are Soviet, 2 Dutch, 1 German, 1 English, 1 translation and 2 American.

SUBMITTED: December 3, 1957

Card 5/5

1. Flames--Temperature 2. Temperature--Measurement 3. Flames --Spectra

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SOV/48-22-6-23/28

AUTHORS: Sobolev, N. N., Potapov, A. V., Kitayeva, V. F., Fayzullov, F. S., Alyamovskiy, V. N., Antropov, Ye. T., Isayev, I. L.

TITLE: The Spectroscopical Investigation of the State of the Gas Behind the Shock-Wave (Spektroskopicheskoye issledovaniye sostoyaniya gaza za udarnoy volnoy)

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya fizicheskaya, 1958, Vol. 22, Nr 6, pp. 730-736 (USSR)

ABSTRACT: This paper describes a practical method of obtaining a high-temperature plasma for research work carried out in laboratories, viz. the method of the "shock tube" (Fig 1). The shock tube is divided by means of a diaphragm into two chambers (for high- and low pressure). As soon as high pressure develops in the high-pressure chamber the diaphragm is caused to burst, and at the same time a shock wave forms in the second chamber round the shock center - i. e. the rarefying wave. Between the fronts of the shock wave and the contacting surface a layer of gas of high temperature is formed which is here described as "lock" (probka). This "lock" moves with the velocity U_2, which is

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somewhat lower than that of the shock wave U_s. The temperature of the "lock" increases with a reduction of the molecular weight of the gas. If the velocity U_s is known, it is possible, by basing on the law of conservation of the mass, the impulse and the energy, as well as on the strength of the ratio of enthalpy, the degree of ionization, and the state of the gas, to determine the 6 unknown quantities: p_2, ρ_2, U_2, H_2, T_2 and α_2 relating to the state of the monoatomic gas located in the "lock". A graphical illustration of 3 states of argon and 3 states in air behind the shock wave is given. The device is described on the basis of a schematical drawing. The chapter dealing with: The Method of Relative Intensities describes the use of the device mentioned for the purpose of obtaining the spectral lines for Li and Na for measuring the temperature by the method of relative intensities. Measurements were carried out photographically and photoelectrically, without as well as with full reabsorption of spectral lines. The chapter: The Generalized Method of Reversing the Spectral Lines is based upon a paper (Ref 7) in which the said method is explained with respect to its application for

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The Spectroscopical Investigation of the State of the Gas Behind the Shock-wave

the purpose of measuring temperature without observing a moment of reversal. In this case the optical scheme is used for carrying out the following measurements: The radiation intensity of the gas in the spectral line, the intensity of the radiation of a source employed for the purpose of comparison, and of temperature. For measuring temperature a device was used which is described by means of a schematical drawing (Fig 5). Finally, a graphical representation of the results obtained by measuring the temperatures of nitrogen and the air behind the impulse wave by means of the photoelectric method of the reversal of spectral lines is given. There are 6 figures and 7 references, 3 of which are Soviet.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute imeni P. N. Lebedev, AS USSR)

1. Electron gas--Spectra 2. Electron gas--Radiation 3. Spectroscopy 4. Shock tubes--Applications 5. Shock waves--Analysis

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"APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3

SOV/48-22-9-18/40

AUTHORS: Obukhov-Denisov, V. V., Sobolev, N. N., Cheremisinov, V. P.

TITLE: Raman Spectrum of Vitreous Germanium Dioxide (Spektr kombinatsionnogo rasseyaniya stekloobraznoy dvuokisi germaniya)

PERIODICAL: Izvestiya Akademii nauk SSSR, Seriya fizicheskaya, 1958, Vol 22, Nr 9, pp 1083 - 1085 (USSR)

ABSTRACT: Owing to the fact that no monocrystals of GeO_2 are found in nature and that the investigation of polycrystals presents great difficulties the authors have hitherto not succeeded in studying Raman spectrum of crystalline germanium dioxide. This report presents the results from an investigation of the Raman spectrum of vitreous germanium dioxide and a comparison with the spectrum of silicon dioxide (Ref 1). The two substances were assumed to have the same structure. Hence the vibration spectra of both substances can be considered as dioxide spectra of only one element, which, however, exhibits a different atomic weight in either case. The polarization of the Raman spectrum

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"APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3

SOV/48-22-9-22/40

AUTHORS: Markin, Ye. P., Sobolev, N. N.

TITLE: The Infrared Reflection Spectrum of Boron Anhydride at High Temperatures (Infrakrasnyy spektr otrazheniya bornogo angidrida pri vysokikh temperaturakh)

PERIODICAL: Izvestiya Akademii nauk SSSR. Seriya fizicheskaya, 1958, Vol 22, Nr 9, pp 1097 - 1099 (USSR)

ABSTRACT: In previous papers (Refs 1-3) an account was given of a thorough investigation of the vibration spectrum of boron anhydride. These studies, however, did not cover the infrared absorption spectrum of the molten boron anhydride, as the thin films of the boron oxide coagulated in melting. In this paper the experience gained in the investigation of the infrared reflection spectrum of boron anhydride at high temperatures is presented. For this investigation a special equipment was built, the scheme of which is given in figure 1. In order to eliminate the continuous spectrum which is emitted by the substance under investigation and by the heated furnace a modulation method was employed. In figure 2 the results of the experiments

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24(3)

AUTHORS: Yegorov, V. N., Kolesnikov, V. N., Sobolev, N. N.

SOV/20-121-3-12/47

TITLE: Concerning the Problem of the Nature of the Arc Discharge in an Atmosphere of Inert Gases (K voprosu o prirode dugovogo zaryada v atmosfere inertnykh gazov)

PERIODICAL: Doklady Akademii nauk SSSR 1958, Vol 121, Nr 3, pp 440-442, (USSR)

ABSTRACT: The authors began their investigations with a direct current arc which burned between 2 pure carbon electrodes at a current of 4 amperes in atmospheres of helium and argon with an admixture of hydrogen and neon. The pressure of those gas atmospheres was equal to normal atmospheric pressure. The authors measured the absolute and relative intensities of 3 hydrogen lines (H_α, H_β, H_γ), 8 helium lines, and 14 neon lines for which the transition probabilities are known. Also the distribution of the intensities of these lines with respect to the radius of the arc column were investigated. A diagram shows the values of $\lg(N_i/g_i)$ found for a mixture of 95 % He, 5 % Ne, 0,01 % H_2; for pure helium with an admixture of ~0,01 % H_2 and for technical helium (~98 % He, ~1 % H_2). N denotes the

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Concerning the Problem of the Nature of the Arc Discharge in an Atmosphere of Inert Gases

(dissociation energy 5,6 eV) in the center of the arc. In the center of the arc also the molecular bands CN, CH, and H_2 are excited in a rather intensive manner. According to all the above-mentioned measurements, the half-width of the hydrogen lines was less than 2 - 3 Å. This is an argument in favor of a low concentration of the ions (electrons) in the discharge and, therefore, of a low temperature of the gas. All the above-mentioned facts lead to the following conclusion: In a low-current column burning between carbon electrodes at a normal pressure in an atmosphere of inert gases, there is no thermal equilibrium. Metal atoms introduced into the discharge may lead nearer towards the equilibrium. There are 2 figures and 6 references, 2 of which are Soviet.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute imeni P. N. Lebedev, AS USSR)

PRESENTED: April 2, by D. V. Skobel'tsyn, Academician

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Some Properties of an Arc Discharge in an Atmosphere of Inert Gases

obey the Maxwellian velocity distribution. Secondly, the gas contains small quantities of atoms of H, C, N and molecules of H_2, CH, C_2 and CN ; these components very strongly absorb the resonance radiation of helium and argon and are ionised. Thirdly, a portion of atoms during the recombination is excited, the overall number of the excited atoms being dependent on the effectiveness of the photo ionisation. The measured excitation temperature should therefore be near to the kinetic temperature. Now, by introducing various metal vapours into the discharge, it should be possible to change radically the conditions in the discharge. This assumption was checked experimentally by preparing the electrodes which were "saturated" with barium and lithium salts mixed with carbon powder. The arc discharge was produced in an atmosphere of argon or helium with an admixture of hydrogen at a current of 5-8 A. The investigation by means of "the transverse pictures" showed that, provided the concentration of metals was sufficient, the radiation of

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SOV/51-6-3-3/28

AUTHORS: Sobolev, N.N., Potapov, A.V., Kitayeva, B.F., Fayzullov, F.S., Alyamovskiy, V.N., Antropov, Ye.T. and Isayev, I.L.

TITLE: Spectroscopic Studies of the State of Gas Behind a Shock Wave. I (Spektroskopicheskoye issledovaniye sostoyaniya gaza za udarnoy volnoy. I)

PERIODICAL: Optika i Spektroskopiya, 1959, Vol 6, Nr 3, pp 284-296 (USSR)

ABSTRACT: The paper describes attempts to measure the temperature behind a shock wave using relative intensities of two spectral lines. Shock waves were produced in a shock tube (Fig.5), 9.2 cm in diameter and 4.5 m long. The high-pressure chamber I (50 cm long) was filled with hydrogen at pressures of 110-130 atm. The low-pressure chamber II (4 m long) was filled with air or nitrogen at 10 mm Hg. The two chambers were separated by an aluminum diaphragm, bursting of which produced shock waves in the low-pressure chamber. The spectrum of radiation emitted by the region behind a shock wave was recorded either photographically or photoelectrically using a spectrograph ISP-51. In the latter case two photo-

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Spectroscopic Studies of the State of Gas Behind a Shock Wave. I

the salts settled on the cold walls of the shock tube and their emission was consequently concentrated near the walls (Fig.9). To ensure a uniform distribution of the emitting substances behind a shock-wave front the authors used gaseous dicyanogen in their second series of experiments. They deduced temperatures from the relative intensities of vibrational bands of cyanogen (dicyanogen dissociates at these temperatures) using the method described by Brinkman (Ref.6) and Smit (Ref.7). Again no reliable values of the temperature behind wave fronts could be obtained (Tables 3,4) because of the long time necessary to establish equilibrium distribution in vibrational degrees of freedom of cyanogen. The authors conclude that the method of relative intensities is suitable only for determination of temperatures above 5000°K; between 1500 and 5000°K the self-reversal method (Ref.6) should be employed. There are 10 figures, 4 tables and 9

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Spectroscopic Studies of the State of Gas Behind a Shock Wave. I

references, of which 3 are Soviet, 2 English, 1
translation of English into Russian and 3 Dutch.

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SOBOLEV, N.N.; BELOUSOV, M.M.; RODIN, G.M.; SVIRIDOV, A.G.; SKOROBOGATOV, N.G.; FAYZULLOV, F.S.

Temperature of the flame of a liquid-propellant rocket engine. Part 1. (MIRA 12:4)
Zhur.tekh.fiz. 29 no.1:27-36 Ja '59.

1. Fizicheskiy institut im. P.N. Lebedeva AN SSSR, Moskva.
(Rockets (Aeronautics)) (Flame) (Temperature--Measurement)

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"APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3

SOBOLEV, N.N.; KITAYEVA, V.F.; RODIN, G.M.; FAYZULLOV, F.S.; FEDOROV, A.I.;

Temperature of the flame of a liquid-propellant rocket engine. Part 2. Zhur.tekh.fiz. 29 no.1:37-44 Ja '59. (MIRA 12:4)

1. Fizicheskiy institut im. P.N. Lebedeva AN SSSR, Moskva. (Rockets (Aeronautics)) (Flame) (Temperature--Measurement)

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SOV/20-127-3-17/71

5(4), 24(8)
AUTHORS: Fayzullov, F. S., Sobolev, N. N., Kudryavtsev, Ye. M.

TITLE: The Temperature of Nitrogen and Air Behind a Shock Wave

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 127, Nr 3, pp 541-544 (USSR)

ABSTRACT: 1) If a shock wave propagates in a shock tube, it is possible, by measurement of the propagation rate of the shock wave u_s, to calculate the temperature T_2, density ϱ_2, pressure p_2, and the velocity of the gas u_2 behind the shock wave if the temperature T_1, density ϱ_1, and pressure p_1 of the gas before propagation of the shock wave are known. For the simplification of calculation, it is assumed in thermodynamics that T and P are constant along the obstruction formed, and that the latter grows linearly with time. The agreement of the calculation carried out under these simplified conditions with the experiment is investigated in the present paper. The experimental data on T_2 and p_2 of the air and the nitrogen behind the shock wave were obtained by the generalized method of the reversal of lines with photoelectric recording.

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The Temperature of Nitrogen and Air Behind a Shock Wave

Good agreement between experimentally and theoretically calculated data was obtained. Moreover, the temperature distribution along the obstruction was investigated in this paper, and its influence exercised upon the calculated values was evaluated. In the case of a small u_s, the temperature was found to remain constant along the obstruction. At a velocity of $u_s \sim 3 - 4$ km/sec, a sharp temperature drop, however, occurred. The two possible ways of explaining this drop are investigated: 1) The temperature along the tube is not constant, and thus also not T along the obstruction. 2) The sodium flashes up with a delay, and the temperature at the end of the obstruction is first recorded. In the second case it was found that the very slight delay of flashing up could not cause the sharp temperature drop, which could be removed, however, by thoroughly cleaning the tube. Agreement between experiment and theory then remained good. This proved the correctness of the assumptions made in thermodynamics. The method of the reversal of lines as used here may also be employed with success for measuring the temperature along the obstruction. It is recommended, at temperatures of up to

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The Temperature of Nitrogen and Air Behind a Shock Wave

3,500°K behind the shock wave, to use the Na-D-line, and at higher temperatures the ion line of Ba. The temperature distribution at the beginning of the obstruction could not be investigated. In the case of nitrogen, an increase of temperature was found to occur at the end of the obstruction, which possibly originated from a chemical reaction of N and the used combustion gas H on the contact surface. In conclusion, the authors thank A. V. Potopov and S. S. Semenov for discussing the results, and Ye. T. Antropov for his assistance in experiments. There are 4 figures and 8 references, 4 of which are Soviet.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute imeni P. N. Lebedev of the Academy of Sciences, USSR)

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SUBMITTED: April 4, 1959

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SOBOLEV, N.N., prof., red.; YAKIMENKO, L.P., red.; ARTYEMOVA, Ye.S., tekhn.red.

[Optical pyrometry of plasma; collection of articles] Opticheskaia pirometriia plazmy; sbornik statei. Moskva, Izd-vo inostr.lit-ry, 1960. 438 p. (MIRA 13:5)
(Plasma (Ionized gases)) (Pyrometry)

APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3"

"APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3

Vsesoyuznoye soveshchaniye po opticheskim i spektral'nym svoystvam stekla i ikh primeneniyu (3rd All-Union Conference on the Optical and Spectral Properties of Glass and Their Application) Leningrad, 1969.

Steklo v opticheskom materialovedenii; trudy Vsesoyuznogo soveshchaniya (Glass in Optical Materials; Transactions of the All-Union Conference) 16-20 noyabrya 1969, Leningrad. Leningrad, Izd-vo Nauka, 1970.
Vitreous State; Proceedings of the Third All-Union Conference on the Vitreous State, held in Leningrad, November 16-20, 1969. Leningrad, Izd-vo AN SSSR, 1970. 434 p. Illustrations, bibliographies. 3,000 copies printed.
(Series: Its: Trudy)

Sponsoring Agencies: Institut khimii silikatov Akademii nauk SSSR. Vsesoyuznoye khimicheskoye obshchestvo imeni D.I. Mendeleyeva
Institut khimii silikatov imeni D.I. Mendeleyeva
Leningradskiy opticheskiy institut imeni S.I. Vavilova

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Ed. of Publishing House: I.V. Suvorov; Tech. Ed.: A.K. Yakhkind

PURPOSE: This book is intended for researchers in the science and technology of glasses.

COVERAGE: The book contains the reports and discussions of the Third All-Union Conference on the Vitreous State, held in Leningrad on November 16-20, 1969. They deal with the methods and results of studying the structure of glass. the structure and properties of glasses, the nature of fused relation between structure, and the crystallochemistry of glass. chemical bond and glass stratification, optical properties and coloration of the silica, mechanism of vitrification, optical properties of compositional properties the electrical properties of glass properties, technical, and code borosilicate the dependence of glass properties and mechanical and code borosilicate ports dual radiation effects, treat glass sections from Soviet and glasses and technology. Other papers in the Yu. Yu. ties of glasses. The Conference was attended by more than 500 delegates glasses. The conference was attended by more than 500 delegates The final session and Engineer, Doctor of Technical Sciences. The following Honored Scientist and Engineer, Doctor of Technical Sciences. The following were cited for their contribution to the development of glass science Institutes were cited for their contribution to the development of glass science and technology: Goudarstvenny opticheskiy institut (State Optical Institute), Institute of Silicate Chemistry AS USSR, Institute Khimii silikatov AN SSSR (Institute of Silicate Chemistry AS USSR), Fiziko-khimicheskiy Institute AN SSSR (Physico Institute AS USSR), Institute fiziki AN BSSR, Minsk), Fizicheskiy Institute AN SSSR (Physicochemical Institute AS USSR), Leningradskiy Institute AN SSSR (Physicochemical Institute AS USSR), Leningradskiy Institute of Physics, Academy of Sciences, Belorusskaya SSR, Minsk), Institute of Physical Chemistry, Academy of Sciences of the Institute Obshchiy i neorganicheskoy khimii (Institute of Physical Chemistry, Institute of General and Inorganic Chemistry, Minsk (Institute of Physical Chemistry, Institute Vysokomolekulyarnykh Laboratory of AN SSSR, Minsk), Institute Molecular Compounds, Academy of Sciences, Belorusskaya SSR, Minsk), Institute Vysokomolekulyarnykh soyedineniy AN SSSR (Institute of High Molecular Compounds, Academy of Sciences, Belorusskaya SSR, Minsk), Goudarstvenny institut elektrotekhnicheskoy promyshlennosti (State Institute for Electrotechnical Industry), Siberskiy fiziko-tekhnicheskiy institut (Siberian Physicotechnical Institute), Gosudarstvennyy institut stekla (State Institute for Glass Fibers), Goudarstvennyy institut stekla (State Institute for Glass), Gosudarstvennyy institut stekla (State Institute for Electrotechnical Industry), Leningradskiy Tomsk (Siberian Physicotechnical Institute), Gosudarstvennyy institut stekla (State Institute for Glass), Gosudarstvennyy institut stekla (State Institute for Glass), Gosudarstvennyy institut stekla (State Institute for Glass

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69274
S/051/60/008/04/012/032
E201/E691

The Vibrational Spectra of [Various] Forms of] Germanium Dioxide Modifications

Raman spectra of the crystalline forms of GeO_2 were obtained from the measured transmission of the exciting line through powder layers of 0.25-1 mm thickness. The Raman spectra of the glassy samples were recorded in the usual way. The infrared absorption spectra (Figs 1-3) in the 2.5-35 μ region were recorded with a double-beam spectrophotometer developed at the Physics Institute of the Academy of Sciences (Ref 11) using powders suspended in paraffin oil. The results obtained are given in Table 1 in Figs 1-3. The spectra of the soluble and glassy forms differed only a little from one another which suggests that their structures are similar. The insoluble form had a completely different vibrational spectrum, showing that it has a different structure (confirmed by X-ray crystallography). The vibrational spectra of the soluble form of GeO_2 and the low-temperature modification of α-quartz were compared and the resultant classification of the GeO_2 spectrum is given in Table 3. There are 3 figures, 3 tables and 15 references, 4 of which are Soviet, 7 English, 3 German and 1 Indian.

SUBMITTED: June 11, 1959

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A Spectroscopic Investigation of the State of Gas Behind a Shock Wave. II

luminance temperature 4750°K in the D-line region). The xenon lamp was itself calibrated by means of a standard incandescent lamp. Light from the calibration source $\mathcal{J}_1$ (Fig.1) passed (via glass windows O_1 and O_2) through a part of the shock tube 3.5 m away from the diaphragm. An ISP-51 spectrograph and two FEU-17 photomultipliers (P_1 and P_2 in Fig.1) were used to compare the light flux coming directly from the excited gas in the shock tube (Φ_x) with the flux ($\Phi_{x+\mathcal{J}}$) emitted by the same gas when irradiated with light from the calibration source. Hence the temperature in the shock tube (T_x) was deduced from

$$T_x = T_{\mathcal{J}} \cdot \left[1 + \frac{\lambda T_{\mathcal{J}}}{C_2} \cdot \ln \left(1 - \frac{\Phi_{x+\mathcal{J}} - \Phi_{\mathcal{J}}}{\Phi_x} \right) \right]^{-1}$$

where $T_{\mathcal{J}}$ is the luminance temperature of the calibration source and $\Phi_{\mathcal{J}}$ is the light flux from that source. The accuracy of the method was ± 60°K at 4000°K and it yielded temperatures behind shock

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E201/E491

A Spectroscopic Investigation of the State of Gas Behind a Shock Wave. II

The ionization method was simpler than the "peaks" method and therefore the former was used to measure variation of the shock-wave velocity along the shock tube. The results obtained for air and nitrogen (Fig.8) show that the shock-wave velocity rose monotonically with the distance away from the diaphragm, reaching a maximum approximately 2.5 m from it. The method of "peaks" was also used to find the length of the "plug" (the region between the shock-wave front and the surface of contact between two gases used in a shock tube, cf. Ref.1). The "plug" length fell with rise of the shock-wave velocity (Fig.9). The method of "peaks" was also employed to investigate the delay between incidence of a shock wave and sodium emission. For this purpose the usual shadow system was supplemented by a monochromator which separated out the D-lines of sodium (Fig.1). Sodium emission and the shadow signals were recorded simultaneously and typical oscillograms are shown in Fig.10. It was found that the D-line emission of sodium begins immediately behind a shock-wave front and reaches a maximum in

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E201/E491

A Spectroscopic Investigation of the State of Gas Behind a Shock Wave. II

10 to 20 μ sec. There are 10 figures and 7 references: 4 Soviet and 3 English.

SUBMITTED: September 28, 1959

Card 5/5

APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3"

"APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3

A Spectroscopic Investigation of the State of Gas Behind a Shock Wave. III.

from ~2000°K at $U_s \sim 1.75$ km/sec to >4500°K at $U_s \sim 4.5$ km/sec; for nitrogen (Fig 7) the temperatures were ~2000°K at $U_s \sim 2$ km/sec and ~4000°K at $U_s \sim 3$ km/sec. These experiments were repeated with argon but here the agreement between experiment and theory was much poorer (Fig 9); the reasons for this discrepancy are discussed.
Acknowledgments are made to A.V. Potapov and S.S. Semenov for their advice and to Ye.T. Antropov and A.A. Sapronov for their help in making the apparatus. There are 9 figures and 10 references, 6 of which are Soviet, 3 English and 1 translation from English into Russian.

SUBMITTED: September 28, 1959

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"APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001651820014-3

S/051/60/009/004/005/034
E201/E191

AUTHORS: Sobolev, N.N., and Cheremisinov, V.P.

TITLE: The Vibrational Spectrum of Crystalline Arsenic Oxide and the Structure of its Molecule

PERIODICAL: Optika i spektroskopiya, 1960, Vol 9, No 4, pp 446-451

TEXT: The authors studied the Raman and infrared absorption spectra of crystalline arsenic oxide. The Raman spectra were obtained on powders with a spectrograph KCT-51 (ISP-51). The infrared absorption spectra between 2.5 and 20 μ were studied by Sidorov (Ref 9). The present authors extended his data to 36 μ; powders were suspended in paraffin oil and a double-beam spectrophotometer with a KRS-5 prism was used. In the Raman spectrum (Table 1, columns 1 and 3) 13 lines were discovered; the most intense of these occurred at 305 and 440 cm-1. In the infrared spectrum (columns 2 and 4 of Table 1 and a Figure on p 447), 7 bands were found between 2.5 and 36 μ, one of which was weak. An analysis of both spectra confirmed Ormont's suggestion (Ref 8) that the arsenic oxide molecule in crystals is As_4O_{10}

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5.5310 1273, 1160, 1227

S/051/60/009/005/004/019
E201/E191

AUTHORS: Markin, Ye.P., and Sobolev, N.N.

TITLE: The Infrared Reflection Spectra of Boron Oxide and Fused Quartz at High Temperatures

PERIODICAL: Optika i spektroskopiya, 1960, Vol.9, No.5, pp 587-592

TEXT: Preliminary results on the infrared reflection spectrum of boron oxide at high temperatures were reported at the Eleventh All-Union Conference on Spectroscopy, held in December 1957. The present paper deals with the infrared reflection spectra of B_2O_3 (between 21 and 1000 °C). For high-temperature measurements a special attachment to a single-beam spectrophotometer IKS-11 (IKS-11) was constructed (Fig. 1). To avoid recording a continuous spectrum emitted by a sample and the furnace at high temperatures, the infrared beam was modulated by means of a disc (2 in Fig. 1) rotating at 9 rev/sec. Radiation from a Silit rod (1), modulated by the disc, was focused by means of mirrors (3, 4 and 5) on the surface of a sample (6). The reflected beam was directed by means of mirrors (7-11) onto the entry slit (12) of IKS-11. From IKS-11 the beam proceeded via a mirror (13) to a bolometer (14) which was connected to an amplifier (the circuit is

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The Infrared Reflection Spectra of Boron Oxide and Fused Quartz at High Temperatures

given in Fig. 2). To prevent the high-temperature emission of the sample from being reflected by the modulator disc and thus reaching IKS-11, the disc was covered with a piece of black matt paper. The infrared reflection spectra of solid and liquid B_2O_3 are shown by continuous curves in Figs. 3 and 4 (the dashed curve in Fig. 4 is the absorption spectrum of vitreous B_2O_3). The infrared reflection spectra of fused quartz are shown in Fig. 5 at temperatures from -190 °C (solid, curve 1) to 2000 °C (liquid, curve 6). The temperature dependences of the reflection band positions (ν) and of viscosity (η) are given for B_2O_3 (curve a) and SiO_2 (curve 5) in Fig. 6. The main features of the reflection spectrum of solid B_2O_3 were retained in liquid phase. In the case of SiO_2 the most intense band (8.9 μ at -190 °C) was observed both in solid and liquid states. The bands of both substances were displaced somewhat towards longer wavelengths by increase of temperature. These observations show that the main structural units of B_2O_3 and SiO_2 were retained on transition

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E201/E191

The Infrared Reflection Spectra of Boron Oxide and Fused Quartz at High Temperatures

from solid (vitreous) to liquid state.

Acknowledgements are made to a member of the staff of the Institute of Metallurgy imeni Baykov, AS USSR, A.F. Volodin, for his help, and to A.N. Danil'chenko for his advice.

There are 6 figures and 24 references: 12 Soviet, 6 English, 3 German, 2 Indian and 1 Belgian.

SUBMITTED: February 25, 1960

Card 3/3

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[illegible]

26.2511

AUTHORS: Dronov, A. P., Sviridov, A. G. and Sobolev, N.N.

TITLE: An Investigation of the State of Krypton Behind a Shock-wave

PERIODICAL: Optika i spektroskopiya, 1961, Vol.10, No.3, pp.312-321

TEXT: The present work is concerned with the spectroscopic study of krypton behind a shock-wave (M = 10-15) and represents an extension of the work reported by V. N. Alyamovskiy and V. F. Kitayeva (Ref.10) and F. S. Fayzullov, N. N. Sobolev and Ye. M. Kudryavtsev (Ref.11). An attempt has been made to investigate the state of krypton from measurements on hydrogen line emission. The hydrogen was present in the gas under investigation either in the form of the natural impurity or was specially added in small quantities so as not to affect the thermodynamic properties of the gas. The paper begins with a brief calculation of the state of krypton behind a shock-wave. The analysis is based on the laws of conservation of mass, momentum and energy and these are written down in the form

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$$\rho_1 U_S = \rho_2 (U_S - u_2), \tag{1}$$

$$p_1 + \rho_1 U_S^2 = p_2 + \rho_2 (U_S - u_2)^2, \tag{2}$$

$$H_1 + \frac{1}{2} U_S^2 = H_2 + \frac{1}{2} (U_S - u_2)^2, \tag{3}$$

The further two equations which are necessary are the equation of state of the gas

$$\frac{p_2}{\rho_1} = (1 + \alpha_2) \frac{RT_2}{\mu} \tag{4}$$

and the Saha equation

$$\frac{\alpha_2^2}{1 - \alpha_2^2} p_2 = K(T_2). \tag{5}$$

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In the above system of equations

$$H = \frac{5}{2}(1+\alpha)\frac{R}{\mu}T + \alpha\frac{N\chi_0}{\mu} \qquad \text{A.}$$

is the enthalpy per unit mass and

$$K(T_2) = \frac{2g^+}{g_0}k\left(\frac{2\pi m_e k}{h^2}\right)^{\frac{3}{2}} T_2^{\frac{5}{2}} e^{-\frac{\chi_0}{kT_2}}. \qquad \text{B.}$$

The symbols are defined as follows: subscript 1 refers to the gas prior to the passage of the shock-wave, subscript 2 refers to the gas behind the shock-wave, p is the pressure, ρ the density, U_s is the velocity of the shock-wave, u_2 is the velocity of the gas particles, α is the degree of ionization, χ_o is the ionization potential, g_o is the statistical weight for a neutral atom and g^+ is the statistical weight of an ion. Eqs. (1) to (5) are then reduced to the single equation relating the degree of

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ionization α_2 to the temperature T:

$$\frac{1-\alpha_2^2}{\alpha_2^2}\cdot\frac{1}{\rho}K-\frac{p_1}{\rho_1}-4(1+\alpha_2)\frac{R}{\mu}T_2-\frac{\alpha_2^2}{1-\alpha_2}\frac{R}{\mu}T_2\frac{p_1}{K}-$$
$$-2\alpha_2\frac{N\chi_0}{\mu}+\frac{5RT_1}{\mu}=0, \quad (6)$$

where N is the Avogadro number and μ is the molcular weight. The degree of ionization α_o can thus be computed for various assumed values of T_o. Knowing T_2 and α_2 it is then possible to calculate p_2, ρ_2 and U_S from the formulae

$$p_2=\frac{1-\alpha_2^2}{\alpha_2^2}K, \quad (7)$$

$$\rho_2=\frac{p_2}{\frac{R}{\mu}T_2(1+\alpha_2)}, \quad (8)$$

$$U_S=\left(\frac{\rho_2}{\rho_1}\frac{p_2-p_1}{\rho_2-\rho_1}\right)^{\frac{1}{2}}, \quad (9)$$

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Having determined α_2, p_2, ρ_2 and U_s as functions of T_2, one can plot graphs of T_2, α_2, p_2 and ρ_2 as functions of U_s or $M = U_s/c_1$, where c_1 is the velocity of sound in krypton (218 m/sec). The present authors have carried out such calculations using the "Ural" computer and some of the results are shown in Figs. 1 and 2. Fig.1 gives the temperature of the plasma T_o behind the front of the shock-wave as a function of M for various values of the initial pressure p_1. Curves 1 to 6 correspond to the following values of p_1, respectively: 1.0, 2.0, 5.2, 7.0, 10.0 and 15.0 mm Hg. Fig.2 shows the degree of ionization, the density and the pressure behind the shock-wave front as functions of M for different values of p_1. The curves marked 1 to 6 correspond to the same values of p_1 as quoted for Fig.1. In the second part of this work a description is given of the apparatus employed to verify this theory. The apparatus is shown schematically in Fig.3. The temperature was determined from the relative intensity of the H_α and H_β lines, and the concentration of charged particles was determined from the broadening of these lines. The

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concentration was calculated from the formula

$$N_i = 3.4 \cdot 10^{14} (\Delta\lambda)^{\frac{3}{2}} \qquad (11)$$

where $\Delta\lambda$ is the half-width in angstroms. The experiments showed that the determination of the temperature from the relative width of H_α and H_β in krypton behind a shock-wave is difficult because of the large width of the H_β line and the presence of a continuous spectrum surrounding this line. Fig.8 shows the experimental points obtained for lg N_i as a function of M (1 - H_α, 2 - H_β, 3 - H_α with addition of H_2, 4 - H_β with addition of H_2; continuous curve - theoretical). As can be seen from Fig.8, the agreement between experiment and theory is satisfactory. The experimental data do not differ from the theoretical values by a factor greater than 1.5 to 2. However, most of the experimental points lie below the theoretical curve. This may be due to: a) reduced gas temperature due to the presence of hydrogen and other impurities in krypton and b) neglect of losses by radiation. Acknowledgments

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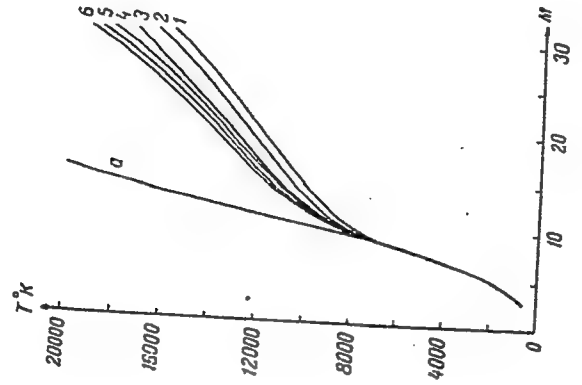
are expressed to G. V. Kazakova for assistance. There are 3 tables, 8 figures and 14 references: 5 Soviet and 9 non-Soviet.

SUBMITTED: May 13, 1960

Fig.1



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S/051/61/011/005/002/018
E202/E192

AUTHORS: Fayzullov, F.S., and Sobolev, N.N.

TITLE: Determination of the effective cross-section for the collision of the excited barium ions with argon atoms

PERIODICAL: Optika i spektroskopiya, v.11, no.5, 1961, 571-576

TEXT: After discussing briefly the inherent difficulties in measuring the cross-section of the non-elastic secondary collision for systems with low relative velocities, i.e. in the partly adiabatic region, and rejecting methods based on the use of the monoenergetic beams and the resonance attenuation, the authors offer their method which was partly described in their previous paper (Ref.2: F.S. Fayzullov, N.N. Sobolev, Ye.M. Kudryavtsev, Opt. i spektr. v.8, 761, 1960). This method is based on the following observation: When a shock wave is propagated through argon and the composition of the latter is studied, the temperature of the excitation of Ba ion at pressures of $p_2 \approx 0.4$ and 4 atm is found to be lower by 1000 and 400 °K respectively, than the calculated equilibrium temperature based on the conservation of energy considerations. With the increasing

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pressure this difference decreases, until at $p_2 \approx 12$ atm both temperatures coincide. This lowering of the measured temperature is not observed in the case of air or nitrogen, but is easily observed when argon atoms collide with barium ions. This effect is attributed to the low effective collision cross-section of the A atoms with Ba ions and is used to evaluate the effective cross-section of the second kind. The value given by the authors is approximately 4×10^{-17} cm^2, which shows that the second kind collision cross-section is by two orders smaller than the gaso-kinetic cross-section. The authors intend to check further the accuracy of this method on systems where cross-section value could be found by alternative methods. There are 1 table and 10 references; 3 Soviet-bloc, 3 Russian translations from non-Soviet publications and 4 non-Soviet-bloc. The English language references read as follows:

Ref. 4: C.W. Allen, Astrophysical Quantities, London, 1955.
Ref. 7: L.O. Olsen, Phys. Rev. v.60, 739, 1941.
Ref. 9: J.G. Clouston, A.G. Gaydon, I.R. Hurle, Proc. Roy Soc., A252, 143, 1959.
Ref. 10: J.R Bates (private information).

Card 2/2 SUBMITTED: December 26, 1960

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21970

24.2120 (1049,1482,1141)

AUTHORS: Nitayeva, V. F. and Sobolev, N. N.

TITLE: Broadening of hydrogen lines in an arc plasma and a shock tube

PERIODICAL: Doklady Akademii nauk SSSR, v. 1[illegible], no. 1, 1961, 1091-1094

TEXT: The present paper gives a comparison between the contours of the H_α and H_β lines determined experimentally and those calculated by Griem et al. (Ref. 5: H. R. Griem, A. C. Kolb, K. J. Shen, Stark Broadening of Hydrogen Lines in Plasma, March 4, ... Report 5455, U.S.N.R.L. Washington, 1960; Phys. Rev., 116, 4, (1959); A. C. Kolb, H. Griem, Phys. Rev., 111, 514 (1958)). Fig. 1 shows the experimentally determined contours of the H lines emitted from a d.c. carbon arc in an atmosphere of argon with 5% H_2. The half-width of the apparatus function was 0.3 A. Fig. 2 shows the same lines determined on a shock wave. H_α was taken in krypton with 1% H_2, and H_β in argon with 2% H_2. There is a

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satisfactory agreement between theory and experiments as long as the apparatus function and Doppler effect, which are not considered in the theory of Griem et al., are negligible. The fact that the concentration of the charged particles determined from the contour of the H_α line and that determined from the half-width if the hydrogen lines agree with the values experimentally determined shows that the theory developed by Griem et al. is correct. It is therefore possible to determine the concentration of charged particles from the broadening of the hydrogen lines by means of this theory. For this purpose, Fig. 3 shows the different relations between the concentration of the charged particles and the broadening of H_β lines. For determining the concentration of the particles, the author recommends the H_β line for a range of concentration of from $2 \cdot 10^{15} - 10^{17}$, and the H_α line for concentrations above $5 \cdot 10^{16}$. The asymmetry of the H_β lines (Figs. 1 and 2) is explained as due to a quadratic Stark effect. Finally, the divergence between theory and experiment in the case of the dependence of the distance between the maxima of H_β lines on the half-width is dealt with and the results shown

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Broadening of hydrogen lines in ...

in Fig. 4 are discussed. There are 4 figures and 8 references: 4 Soviet-bloc and 4 non-Soviet-bloc.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Institute of Physics imeni P. N. Lebedev, Academy of Sciences USSR)

PRESENTED: December 15, 1960, by L. A. Artsimovich, Academician

SUBMITTED: December 3, 1960

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ESD-3/AFWL Ps-4/Pd-4/Pr-4 WW/JD

ACCESSION NR: AR3002666 S/0124/63/000/005/B024/B025

SOURCE: Rzh. Mekhanika, Abs. 5B121

80

AUTHOR: Alyamovskiy, V.N.; Dronov, A. P.; Kitayeva, V. F.; Sviridov, A. G.; Sobolev, N. N.

TITLE: Experimental determination of the concentration of charged particles in argon and krypton behind a shock wave

CITED SOURCE: Sb. Vopr. magnitn. gidrodinamiki i dinamiki plazmy. v. 2. Riga, AN LatvSSR, 1962, 379-386

TOPIC TAGS: argon, krypton, shock wave, spectroscopy, contour line, electron temperature

TRANSLATION: Spectroscopic studies of the states of the inert gases argon and krypton behind shock waves were made. The contour lines of hydrogen in krypton were studied behind the incident wave; in argon, behind the reflected. The hydrogen admixture was about 1-5%. The initial pressure was of the order of 0.2-1 mm of mercury. In the argon behind the reflected wave, the calculated

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temperature was of the order of 12000-13000° K. The concentration of electrons was determined by the method of comparison of the experimental contour lines with the theoretical ones, and the temperature was determined using the assumption of thermodynamic equilibrium. Yu.R.

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E032/E514

26.2311

AUTHORS: Kitayeva, V.F., Obukhov-Denisov, V.V. and Sobolev,N.N.

TITLE: Concentration of charged particles in the plasma of an arc burning in an argon-helium atmosphere

PERIODICAL: Optika i spektroskopiya, v.12, no.2, 1962, 178-185

TEXT: The authors report an experimental study of the profiles of the hydrogen lines H_α, H_β, H_γ and H_δ emitted by the plasma of an arc excited in an argon and helium atmosphere in the current range 1-200 A. The arc was produced in a special water-cooled chamber. Hydrogen was added to argon and helium in amounts corresponding to 0.2-5% by pressure. The central part of the arc was photographed with the grating spectrograph ДФС-4 (DFS-4) whose dispersion in the second order was 6.9 Å/mm. The spectrograph slit was 0.025 mm and the corresponding half-width of the instrumental function was 0.3 Å. This half-width was determined experimentally from narrow lines emitted by a Geisler hydrogen-filled discharge tube. The line profiles were compared with the theoretical profiles based on the work of H. R. Griem, A. C. Kolb, K. J. Shen (Ref.5: Stark broadening of

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hydrogen lines in plasma. March 4, 1960, N.R. Report 5455, U.S. N.R. L., Washington; Phys. Rev., 116, 1960; A.C. Kolb, H.R.Griem. Phys. Rev., III, 514, 1958). A satisfactory agreement between the theory and experiment was established. This comparison also yielded the charged-particle concentrations for arcs produced in argon and in helium in the current range 1-200 and 6-200 A, respectively. The results obtained are shown in Fig.5. There are 8 figures.

FIG.5 Legend. Concentration of charged particles N_i in the plasma of an arc as a function of the arc current.
a - neglecting the instrumental functions and Doppler broadening,
b - allowing for these two effects: I - argon, II - helium.
The experimental points are identified as follows: Argon: 1-5% H_2 flashed at 10 litres/min, electrode separation 12 mm; 2-5% H_2 at 10 litres/min, electrode separation 25 mm; 3-5% of H_2 at 3 litres/min, ℓ = 12 mm; 4-2% H_2 at 10 litres/min,

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Concentration of charged ... S/051/62/012/002/004/020
E032/E514

ℓ = 12, 25 mm. The numbers on the curve indicate the temperature in °K.

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SOBOLEV, N.N.

Spectroscopy in the United States. Opt. i spektr. 12 no.3:449-451 Mr '62. (MIRA 15:3)

(United States--Spectroscopy)

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E032/E314

26.1135

AUTHORS: Dronov, A.P., Sviridov, A.G. and Sobolev, N.N.

TITLE: Continuous emission spectrum of krypton and xenon behind a shock wave

PERIODICAL: Optika i spektroskopiya, v. 12, no. 6, 1962, 677 - 690

TEXT: A review of the work reported by H.E. Petschek et al (Ref. 1 - J. Appl. Phys., 26, 83, 1955) and by W. Roth and P. Gloersen (Ref. 3 - J. Chem.Phys., 29, 820, 1958; Ref. 4 - -do- 1959, 31, 844; Ref. 5 - -do- 1960, 32, 1876; Ref. 6 - Phys. Fluids, 3, 857, 1960) leads the authors to the conclusion that there are at least two mechanisms responsible for the emission of the continuous spectrum in inert gases (recombinational mechanisms of Kramers and Unsold and the radiative transmission mechanism of Roth and Gloersen). The present work was carried out to investigate the spectrum of xenon and krypton behind shock fronts in the Mach-number range 11.5 - 15. The shock waves were produced in a glass tube (Ref. 10 - N.N. Sobolev et al - Optika i spektroskopiya, 10, 312, 1961)

Card 1/2

...uous spectrum
... of electrons with ions
... particles in these experiments
...ibrium values. There are 10 figures and 3 tables.

...pril 8, 1961

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